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THE ADVENTURE OF POPULATION GROWTH[1]

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Since the organization of the American Statistical Association nearly a century ago, problems affecting the modern state, society, and industry have multiplied in number and gravity. Most of them have arisen directly or indirectly from the extraordinary increase in the population of civilized nations during this period. Hence, in some degree to measure these problems, the collection of statistics in increasing detail and with increasing accuracy has become indispensable in our time.

Economics is a definite and important science. Statistics is a scientific method. It is the characteristically modern way of collecting and marshalling facts. These facts in turn become the raw material of the economist, but from the standpoint of this Association I rejoice that modern economics is tending to become more and more inductive and statistical. In each field, however, there remains much independent work to be done, and the statistician may find at hand, wherever he turns, material from which it is possible to construct reliable statistical tabulations, often of surprising interest and importance.

I shall ask you this evening to follow a brief account of the phenomenal increase of population of European blood which occurred in one century, inquiring especially whether any resemblances exist between population changes in Europe and those in the United States; if so, to what extent, and to what these increases appear to lead.

It is not probable that the immense increase during the century which elapsed from 1810–15 to 1910–20 in the number of human beings of European blood residing in Europe and elsewhere had a counterpart on any considerable scale at any other period of human history. This sudden and phenomenal growth is a fact of profound importance. It is the result of far-reaching influences, all of which are not yet fully spent or understood. Already it is a population adventure, and it leads in

[1] The presidential address read at the Annual Meeting of the American Statistical Association at Chicago, December, 1922.

the future to further adventure, limitless in its possibilities for the human race.

This century of great human increase was bounded at its beginning and its ending by the greatest wars known. In 1815, just as the Napoleonic wars ended, the population of Europe, including the number or equivalent of persons of European blood in the Americas and elsewhere throughout the world, probably did not much exceed 210,000,000 persons. A century later, as Europe was entering upon a great war exceeding in misery and costliness all earlier conflicts, the population of Europe, and again including persons of European origin in the Americas and elsewhere, approximated 645,000,000.[1]

It is necessary at the outset to emphasize the radical difference in the rates of increase of population before the nineteenth century as compared with those of our own time. Confining ourselves to Europe, it is hard to realize in this swiftly moving age how small a change in the number of inhabitants probably occurred in a hundred-year period. These early centuries in Europe, let us say from the year 1000 to 1700, were hand-power centuries. Human beings were comparatively few in number; they tilled the soil, utilized beasts of burden and to a limited degree, windpower, and engaged in public and private warfare as their principal occupation. Change from century to century was thus very gradual.

One estimate places the growth of European population from 1570 to 1670 at one-third. If we waive the important matter of variation in percentage of increase and accept as constant from the year 1000 the liberal one-third estimated for the seventeenth century, then a population in round numbers of 19,000,000 for all Europe would have been required at the earlier date to furnish the 194 millions, the known approximate population, in 1815. In that event, the increase in 800 years would have been less than one-half of the increase in the number of persons of European blood which took place during the single century 1815 to 1920.

It is possible, however, that in the year 1000 the number of inhabitants in all Europe was greater than 19,000,000, and that the increase for several centuries at least was less than one-third, but that the proportion tended to increase up to the one-third suggested as existing from 1570 to 1670.[2]

[1] Whitaker, 1915, p. 99.

[2] The population of the City of Geneva, Switzerland, is stated in the Encyclopedia Britannica on the authority of an early writer to have been 5,800 in 1356. In 1572 it was 11,000. This was an increase of approximately one-third per century for part of the fourteenth, the fifteenth, and part of the sixteenth centuries. In 1782 the population was 24,712, an increase at the rate of about 50 per cent per century for part of the sixteenth, the seventeenth, and part of the eighteenth centuries. In 1880 the population of Geneva City was 76,197, an increase during the nineteenth century period at the rate of about 200 per cent.

A little later, in 1701, a fairly well established approximation exists for England and Wales, by which the population was set for that year at 6,121,525. This figure, compared with 8,892,536—the known population in 1801—suggests with somewhat increased signs of accuracy an eighteenth century increase of 45 per cent. Süssmilch (quoted by Prof. W. F. Willcox[1]) sets the population of Europe in 1747 at 150,000,000. From this figure we find that the 63-year increase (1810) was about 30 per cent. With such slender basis of fact, I venture to suggest for your approval, or at least for your consideration, the likelihood that (1) the population of Europe in the year 1000 must have been between eighteen and thirty millions; (2) population increase was extremely slow, but tended century by century to gather headway; and (3) an increase of possibly 33 per cent per one hundred years was reached by the seventeenth century, and of 50 per cent by the eighteenth century.

In this unsatisfactory way only are we able to establish a background for the figures, meager enough to be sure, available for 1815, and in particular to contrast early growth in what we may call the hand-power period prior to 1815 with the astonishing growth and its attending phenomena that have characterized our own period.

You are familiar with the beginnings of census taking in Europe—the first enumerations made at the opening of the nineteenth century in France and Britain, inspired to some degree, it is pleasant to believe, by the proof which our own First Census a decade earlier must have afforded that a nation-wide enumeration was practicable; and you recall the fact that estimates of population in other western nations were becoming more and more frequent and reliable. Levasseur estimated that in 1810–15 the total population of Europe, including European Russia, was about 185,000,000.

Including the Balkan States, the total population in 1810–15 appears to have been approximately 194,500,000. Half a century later, 1860, this total had increased to 293,000,000, and after another half century, 1910–15, it had reached 454,000,000. Here was an increase of 51 per cent during the first half and 55 per cent during the second half of the century, in absolute figures, 98½ millions and 161 millions respectively.[2]

In 1815 the condition of the nations of Europe seems to have resembled rather strikingly that of their descendants a century later. Of the fifteen nations here specified, nine had then just emerged from the welter of conflict more or less continuous for a decade or more. Almost

[1] "Expansion of Europe in Its Influence upon Population," *Studies in Philosophy and Psychology*, 1906, p. 42.

[2] See Table 1, page 13.

all of them were prostrate and deeply in debt. In fact, the actual indebtedness of the six leading nations, including that part of France's obligations later repudiated, was $8,450,000,000, a total easily equivalent to two or three times that amount in our own time. It is significant that some of this great amount, especially that portion of the British debt represented by permanent government securities, is actually in effect unpaid today.

Yet, in 1815, with many new boundaries, huge indebtedness, comparatively limited population, and seemingly a discouraging outlook for economic recovery, Europe nevertheless was actually on the verge of an immense industrial awakening, with corresponding stimulus to human increase. The influence of this awakening was everywhere felt. It was most marked, however, in those countries which took the lead as distinctly industrial states. Of the approximate hundred million increase in the population of Europe up to 1860, 41 millions were contributed by Great Britain and the two Germanic empires, 29 millions by Russia, and the remaining 28½ millions by some twelve other nations, including the present Balkan States.

Population all over Europe tended to increase even more liberally as this distinctly industrial and commercial century advanced. The passage of the second half emphasized the growth, first, of those states which had taken the lead in manufacturing and commerce, such as Great Britain, Germany and Austria, and second, of a number of nations previously having rather sluggish population increase, such as Italy, Holland, Spain, and several of the smaller countries. In absolute increase nearly all the countries of Europe showed stimulated increase from 1860 to 1910–15 as compared with corresponding figures for 1810–15 to 1860.

Here, however, we are inclined to ask whether the noteworthy growth of European nations during the past century affected urban and rural areas to the same extent, or whether the extreme industrial development of the period decreed greater urban increase. It is difficult to ascertain the population of many large cities in Europe in 1810–15 outside of Great Britain and France. It can be determined[1] that a group of twenty-five,[2] including most of the great cities, had a population of approximately three and a quarter millions (3,215,000), about 1800–15. In 1910–15 the corresponding total was twenty-two and a quarter millions (22,276,000).

This was an increase of nearly 600 per cent. The conclusion seems reasonable that if the population of twenty-five large cities expanded

[1] Encyclopedia Britannica.

[2] See Table 2, page 13.

about sevenfold in a century, the population of the other principal cities of Europe increased at about the same rate.

In 1910–15, in Great Britain and upon the Continent of Europe, there were 369 cities each having not less than 50,000 inhabitants.[1] The aggregate population of all these cities was seventy-four and one-fourth millions (74,315,684). If the increase for the century in this entire group had corresponded to the increase already noted for 25 of the number, then these 369 cities had an approximate population in 1810–15 of but 10,750,000 and they together represented less than 6 per cent of the total population at that period as compared with nearly 17 per cent in 1910–15.

But if the population of Europe, exclusive of the large cities, increased during the century here considered a little more than 125 per cent, and if the large cities by themselves increased nearly 600 per cent, clearly showing the control and stimulation of industrial and commercial activities, what of the United States? Are we in this country revealing population changes at all resembling those of Europe, or are we following independent lines of growth?

Turning backward a century from our last census, in 1820 the population of the United States was slightly over nine and a half millions (9,640,000). During the next fifty years (to 1870) there was an increase of approximately 300 per cent. During the next half century, from 1870 to 1920, the population of the United States increased approximately 165 per cent. The population of Europe, on the other hand, increased 51 per cent from 1810–15 to 1860–65. Half a century later, at the end of the period we are considering, the increase was 55 per cent. Here is a surprising dissimilarity in the two half-century increases in the United States, caused by slowing down of increase, and a surprising resemblance between the two half-century increases in Europe. Thus far in our analysis there appears to be no resemblance between the increases shown by the Old World and the New.

Here a new consideration presents itself. In 1810–15 the population of Europe was native of native parentage and race. In 1860 and again in 1910–15 the population was native, and thus strictly comparable. In 1820 the white population enumerated in the United States was almost exclusively descended from the colonial settlers. So true was this that the element foreign-born and of foreign parentage in 1820 was estimated in 1850 to have been no more than 360,000. The negroes were of more recent arrival, but most of them were born of American-born parents. Half a century later, 1870, the total population was nearly forty millions (39,818,449[2]). What part of that total (1870) was

[1] See Table 3, page 14.

[2] Revised figure for 1870: 1910 Population. Vol. I, p. 24.

comparable with the population of the United States in 1820? On the other hand, what part of the population in 1870 was not only foreign-born but of recent European parentage, and thus justly entitled to be classed at that period as Europe's product rather than the product of America?

It has been my privilege during the past year to prepare a publication for the federal Census Bureau which contains a study of native and contributed stock.[1] It enables us to approximate the number of persons of European birth or origin arriving after 1820 who were enumerated in 1870. This number was approximately 10,250,000, of whom possibly 8,000,000 ought to be credited to Europe in 1860–65, in order to appraise accurately Europe's increase. Upon making this credit, the percentage of European population increase from 1810–15 to 1860–65 advances from 51 to 55, and the corresponding increase in the population of the United States (1820–70) shrinks to 230 per cent. These percentages, though much closer than the gross figures first quoted, still bear no resemblance at that period, and none, indeed, should be expected.

It is with the second or last half-century that we are principally concerned. In 1920 the white and colored population of original stock in the United States (corresponding to that just established for 1870) was approximately fifty-eight and a quarter millions (58,219,000); and the element of our population belonging to Europe's increase had grown to forty-seven and a half millions (47,491,000). Crediting this element to Europe as a just part of Europe's increase for the half century preceding 1910–15 results in a European increase of 71 per cent for the second half century, as compared with 101.6, to which figure by this adjustment the increase for the United States 1870 to 1920 now shrinks. During this half century, however, Europe's contribution was liberal to South America and to other distant lands. Doubtless these contributions also should be included in Europe's human product during the period considered. By making this added credit, the percentage of European increase rises to about 76, as compared with the distinctly American increase previously stated as 101.6. Thus it appears probable that if European increase were merely to remain stationary, the marked slowing down of increase long in evidence in the United States would mean a constantly closer approach to the same rate of increase for both continents.

Turning to a comparison of the rate of increase of the urban population of Europe with that of urban increase in America, we are again confronted by the fact that the increase shown by the cities of Europe,

[1] Increase of Population in the United States, 1910–20, U. S. Census Bureau, 1923, p. 195.

like that of the entire Continent, was contributed almost exclusively by the natives of the lands in which the cities themselves are located. In London, for example, the foreign-born element in the population is only about 3 per cent. On the other hand, much of the extraordinary growth of American cities was secured by appropriating a good share of Europe's increase. The total population in 1920 of 122 cities of the 144 having 50,000 or more inhabitants was thirty-one million (30,910,552), and the corresponding total for 1870 was six and three quarters millions (6,850,693). This was an increase from all sources of more than 300 per cent. What was the per cent of increase of European cities during the corresponding half-century? Since they were unaided by extensive foreign immigration, the rate of their total increase must have been much lower than that recorded by American cities. Of the 369 cities previously referred to as having 50,000 or more inhabitants in 1920, the population in 1860–65 can be ascertained without undue search for 169. This, however, proves to be a representative group, since practically all the countries of Europe are included.[1] These 169 cities increased from nearly twenty-two millions (21,880,343) to fifty-four millions (54,451,513), or 149 per cent. This is approximately half the rate of natural increase reported by American cities when reinforced by a continuous stream of immigration. Obviously no real comparison can be made with that sort of increase. What was the normal growth of cities in the United States during the half-century from 1870–1920, when divested of European aid, since such aid must be regarded as merely a temporary and an artificial means of increase?

In 1870 the number of native whites was recorded by the census. This class is reasonably comparable with the class, native whites of native parents, returned by the census half a century later. Of the 144 cities having 50,000 or more inhabitants in 1920, the native whites in 1870 can be ascertained for 122. They numbered four millions (4,081,789). The corresponding figure in 1920 was slightly over eleven millions (11,162,239), an increase of 173.5 per cent.[2]

	1920	1870
Native whites	20,857,465	4,081,789
Native whites of native parents	11,162,239	.....
Foreign-born	6,858,947	2,210,535
Negroes and others	1,876,551	442,479

Of the great number of foreign-born and their children withdrawn from American cities, by this computation a proportion, though prob-

[1] See Table 4, page 14.
[2] Compilation, U. S. Census Bureau, 1922.

ably not large, had been natives or residents of European cities. Had this proportion amounted to 20 per cent, the increase from 1860–65 to 1910–15 of the 169 cities here considered, resulting from crediting these persons to the group, rises to about 155.1. It thus appears that the rates of increase of urban population in the United States and Europe, when sources of increase are made reasonably comparable, prove to be nearly the same. This similarity suggests that industry and commerce influence rates of population increase to about the same degree upon both sides of the Atlantic.

If the two great sections of European blood—the inhabitants of Europe and America—are combined, the percentage of increase proves astonishingly uniform. The aggregate population of Europe and the United States increased during the first half of the last century, 1810–20 to 1860–70, 63 per cent, and during the second half, 68 per cent.

Population changes in Europe and America are, after all, much alike. The percentages of increase shown by each are tending to become substantially the same, as merely relating to parts of one great race—the contribution, on the one hand, of separated sections or national entities, on the other, of a great conglomerate drawn from these separate nations and fused in America. If this be accepted, what of the future?

If the increase during the coming century in the population of Europe, North America, and the estimated number of persons of European blood elsewhere were to be placed at the one-third per century rate already suggested as likely to have prevailed for the period prior to 1800, the number of persons of European blood in 2020 would be 860 millions; but if the rate of increase shown for the past century by Europe and the United States combined were to be maintained to 2020, the number of persons of European blood living in that year would reach the amazing total of 1,980,000,000.

Inspection of these possible totals creates the impression that shrinkage of increase back again to an absolute of not over one-third for a century is more likely to occur than continuation of the exceptional rate of increase shown from 1810–15 to 1910–15, which would lead to a total number of persons of European antecedents greater than all the present inhabitants of the globe combined. The former would represent a population capable of living with no very radical modification of our present conditions of existence; the latter would represent an adventure in population growth almost beyond comprehension, and also would mean changes in all the activities of life probably much more radical than those which have occurred since 1815, resulting in an almost inevitable lowering in the scale of living. Consideration of the general figure of growth in number of persons of European blood seems,

therefore, to tend toward this conclusion: Increase during a century extremely prolific in humanity appears to be slowing down in Europe and America and to lean again toward earlier rates of growth. Any upward variation shown is likely to come from continents and islands still awaiting development.

Here, clearly, we reach the confines of the statistician's domain. The adventure of future population increase belongs to the food specialist, the sociologist, biologist, and economist. We have already noted that so vast is the population of European blood today that in the short space of the 100 years reaching to 2020, two equally possible rates of increase may lead to a total population of European blood differing, according as the one or the other rate is employed, by more than one billion persons.

Two factors will chiefly determine the liberality of future increase. They are the food supply and the quality (both intellectual and physical) of the race. I venture, in closing, to invite your attention to the opinions of four distinguished students who have recently written upon aspects of these two subjects, from the standpoint respectively of food expert, historian, eugenist, and biologist.

Professor J. Russell Smith in his volume, *The World's Food Resources*,[1] published just after the war, observes:

> Food we can have in abundance if we devote our time to the conquest of the earth and to the utilization of nature, rather than to conquest of each other. . . . We have become dependent on a great fabric of trade. When it is destroyed, we die. It is only in the last hundred years, the century of steam and a sea clear of pirates, that man has begun to possess and utilize the earth to any great extent, and we are only at the beginning of the possibilities of such utilization. . . . Science every day enables us to have some new commodity where before there was waste. Because of this creation, there is good reason to believe that the available resources of the world are increasing quite as rapidly as the population, and that they will continue to do so for a number of generations, if man devotes himself to science and industry rather than to war.

Professor Smith further points out the necessary tendency toward a larger proportion of grains and vegetables and fish as population increases, and emphasizes the immense food possibilities of Indian corn and sea life such as small floating mollusks, especially the South Sea pteropod. From such an exhaustive study as that made by Professor Smith a strong impression is created that limitation of population by lack of food is remote, though later generations may come to corn meal porridge and pteropods. I confess, however, to some furtive doubts as to the virility and creative power of Europeans or Americans after a couple of generations have subsisted on mush and mollusks.

[1] Pp. 3, 4, 5, 6, 520, 534, 541.

But what of the quality of the race, what of its power and virility, its ability to grow by creating new means of subsistence, its ability to achieve? And achievement, let us remember, has been the dominant note of the past century. In Europe, during the creative period just closed, the vast industrial awakening and development of transportation aroused the nations and inspired growth in all directions. In America, on the other hand, says the historian, in this instance Professor F. J. Turner,[1]

> . . . the fluidity of American life, this expansion westward with its new opportunities, its continuous touch with the simplicity of primitive society, furnish the forces dominating American character. . . . Our early history is the study of European germs developing in American environment. . . . The transformations through which the United States is passing in our own day are so profound, so far-reaching, that it is hardly an exaggeration to say that we are witnessing the birth of a new nation in America. These changes have been long in preparation, and are, in part, the result of world-wide forces of reorganization incident to the age of steam and large-scale industry. . . . The future alone can reveal how much of the courageous creative American spirit . . . can be carried over in the new age which is replacing the era of free lands . . . by complex industrial development and increasing resemblances and connections between the Old World.

These comments of the historian imply some solicitude for the future. There is a note of anxiety lest the man-power of the Republic, without the great objective of a continent to break and states to erect, and confined in thickly settled areas, may go stale.

From a different point of view, the eugenist, Professor Samuel J. Holmes,[2] goes further. He quotes LaPouge as asserting that "as civilization becomes more advanced, the evil effects of the various forms of social selection become more intense," and then says:

> Everywhere the nemesis of degeneracy hangs threateningly over the organic world. The attainment of any degree of complexity or perfection of organization is no guarantee against deterioration. There is not the slightest ground for believing that man himself is in any degree shielded from its insidious influence. . . . Of all our national resources, the most important is our supply of men of superior stock, and we are approaching a period in which the problem of the conservation of this resource is becoming more and more pressing. . . . The trend of racial development has changed . . . but however the process of racial fusion may work out, it is evident that the growing amalgamation of races and peoples, and the extension of civilization over the earth, will leave no room for the replacement of decadent products of civilization by superior stocks which have not yet been overtaken by culture. . . . That civilization . . . has a profound effect upon our biological development is a conclusion that cannot be escaped. . . . In all countries increase of population has sooner or later to come to a standstill. . . . Increased means of production may for a while keep pace with growing numbers of inhabitants, but in time growth of population must bring about its own check.

[1] *The Frontier in American History*, pp. 2, 3, 22, 311.
[2] *The Trend of the Race*, pp. 3, 5, 6, 121–2–3–9, 139.

It is in his discussion of the declining birth rate, however, that Professor Holmes presents the most serious phase of the modern population problem. He says:

> The most serious menace to racial welfare, not only in America but in most civilized lands, is the relative sterility of superior types of humanity. . . . We are losing the elements of our population that have achieved success financially, socially or in the field of intellectual achievement. Speaking generally, none of these classes is reproducing itself. This condition is quite as bad in Europe, at least in several countries, as in the United States. It constitutes a serious menace to our present social welfare and one which is striking at the very roots of our civilization. The menace is all the more dangerous because its effects do not, like those of war, pestilence and famine, intrude themselves upon our notice. . . . The elements of the population that are of subnormal mentality exhibit at present the highest degree of fecundity. . . . When we attempt to gain a comprehensive view of the forces which are changing human inheritance, it becomes apparent that those forces which have been called into action as the result of the development of our culture are in large part *racially destructive.*

Thus speaks the eugenist. A similar opinion, slightly more definite, has been expressed by the biologist. In the November issue of the *Atlantic Monthly,* Professor Vernon Kellogg made an important contribution to the study of this subject. He says:

> As a matter of determined fact, most civilized nations are not having their succeeding generations well born. . . . It is not merely the decline in the birth rate which we show in company with the nations of western Europe that is so disturbing, but the fact that this decline is selective, and is most marked in those classes or parts of the population which we can least well afford to have reduced. . . . With regard, in particular, to the matter of inherent—that is, inherited—low mental capacity, the revelations of the ingenious tests for intelligence . . . to 1,700,000 drafted American soldiers, show us amazing facts. . . . The tests of these drafted soldiers showed that 4.5 of the examined men could be rated as of "very superior intelligence," 9 per cent "superior intelligence," 16.5 per cent "high average intelligence," 25 per cent "average intelligence," 20 per cent of "low average intelligence," 15 per cent of "inferior intelligence," and 10 per cent of "very inferior intelligence." In a democracy like ours, such a representation of mental levels within the population gives one food for serious thought. What of the future of the Republic? What of the future of the evolution of the race? Are we going to be capable, mentally capable, of making the most of the opportunities for racial progress which social evolution has put into our hands? . . . The biologist stands aghast at what he sees happening. He knows what the consequences of flouting Nature are.

It can easily be claimed that some confirmation of these forecasts appears in the increasingly destructive tendencies of our own time; in the social changes; in extreme restlessness; in the irrational schemes for government and finance; in the exaltation of hand toilers, accompanied by depreciation or actual persecution of the cultured, prosperous, and intellectual; in the persistent idea that everybody can reach the top,

and by short cuts or force; in the systematic attempt to ignore mental inequalities. Such things strongly suggest that in the whole social structure there is appearing an increasing proportion of the mentally dull. Yet these signs are not conclusive. They may be in part, at least, post-war phenomena, but it is clear that fear lest such an agreeable explanation may not be adequate troubles many students of our time. "The most interesting question in the world," says J. M. Keynes, "is whether progress will be resumed, or whether the magnificent episode of the Nineteenth Century is over."

Therefore, the worker in population statistics, impressed but not convinced, returns to his own point of observation. Again he analyzes mere increase of population regardless of the causes producing such increase. He observes that the numbers of men remained extremely limited until our own time or near it, that this was followed by the evident release of the nations of Europe and America from those influences—whatever they were—which limited increase, and the consequent rapid growth of population everywhere. He sees the assault by fast increasing millions upon the stored-up resources of the earth at a rate insuring exhaustion at no very distant period if the drain continues unchecked.

From such a survey it becomes clear that if the race still has ahead of it long centuries of anything more than mere existence, a new limiting influence is extremely likely to appear. Are the eugenist and biologist already defining it? Have they in these quoted sentences indicated the new and subtle power arising within man himself which in consequence he cannot overcome, in effect a new parasite to sap virility and compel men by a process, involuntary but irresistible, to increase the proportion of physically and mentally weak? Thus, in the last analysis, is man to be made to burn himself out? By such a sinister process are all problems of increase to disappear, and is earth's heritage, or what is left of it, by this means to be preserved for the possible use of generations to follow?

These are questions of grave importance. As for myself, I am neither an optimist nor a pessimist. On the one hand, I cannot visualize the tribes of men continuing to increase at the rate indicated for the last century, at least without serious penalties. On the other, I cannot foresee early decay so that our descendants at no distant period shall become one with Nineveh and Tyre. Between these two extremes there must be some foothold. But from his watch tower the worker in statistics beholds with awe the rising tide of mankind and the problems that rise with it in gravity and number.

TABLE 1. POPULATION OF THE COUNTRIES OF EUROPE, 1810–15, 1860–65, 1910–15

Country	1810–15	1860	1910–15	Per cent of increase	
				1810–15 to 1860	1860 to 1910–15
Great Britain	18,510,000[1]	29,321,000[1]	46,500,000	58.4	58.6
France	29,676,000[2]	37,382,000	39,600,000	26.0	5.9
Germany	24,500,000[3]	45,013,000	64,926,000	83.7	44.2
Italy	18,000,000	21,895,000	36,546,000	21.6	66.9
Austria-Hungary	25,000,000	35,019,000	49,211,000	40.1	40.5
Belgium	4,900,000	4,530,000	7,424,000	....	63.9
Holland		3,500,000	6,449,000	....	84.3
Spain	10,540,000	13,936,000[5]	19,951,000	32.2	43.2
Portugal	2,930,000	3,584,000	5,546,000	22.3	54.7
Balkan States	9,500,000	12,000,000	16,800,000	26.3	40.0
Sweden	2,350,000	3,917,000	5,522,000	66.7	41.0
Switzerland	1,800,000	2,700,000	3,742,000	50.0	38.6
Denmark	1,810,000	2,605,000	2,941,000	....	12.9
Norway		1,434,000	2,392,000	....	66.8
Russia in Europe	45,000,000[4]	73,992,000	141,679,000	64.4	91.5
Greece	.....	2,000,000[6]	4,821,000	....	....
Total	194,516,000	292,828,000	454,050,000	50.5	55. 1

[1] Whitaker, 1915, p. 496.
[2] Census of France, 1911, p. 16.
[3] Bertillon.
[4] Statesman's Year Book, 1915, p. 1272.
[5] Gazetteer, 1864.
[6] Adjusted.

TABLE 2. POPULATION OF 25 EUROPEAN CITIES, 1810–15 to 1910–15

Country	No. of cities	Population		Per cent of increase
		1810–15	1910–15	
Great Britain	10	1,424,000	11,630,000	716.7
France	9	1,076,000	5,023,000	366.8
Germany	1	197,000	2,071,000	951.3
Austria	1	231,000	2,150,000	830.7
Belgium	1	40,000	313,000	682.5
Italy	2	222,000	964,000	334.2
Switzerland	1	25,289	125,520	396.3
Total	25	3,215,289	22,276,520	592.8

TABLE 3. AGGREGATE POPULATION BY NATIONS OF 369 CITIES HAVING 50,000 INHABITANTS OR OVER, 1920

Group	No. of cities	Population
Great Britain	34	14,072,486
Germany	86	16,611,501
Belgium	6	1,428,012
France	39	7,497,692
Austria-Hungary	27	4,522,532
Norway	2	318,701
Switzerland	6	671,194
Sweden	4	767,773
Italy	32	5,300,567
Denmark	2	572,248
Balkan States and Greece	15	2,512,088
Finland	2	224,950
Netherlands	11	2,002,447
Spain	21	2,926,367
Poland	8	1,767,327
Portugal	2	629,368
Russia	72	12,490,431
Total	369	74,315,684

TABLE 4. POPULATION OF 173 CITIES OF EUROPE, 1910–15 TO 1860–5[1]

Country	No. of cities	1910–15	1860–5
Total	169	54,451,513	21,880,343
Austria	1	1,800,000	587,000
Belgium	6	2,428,012	737,695
Denmark	2	572,248	166,152
France	38[2]	7,428,989	4,275,543
Germany	39	10,941,141	2,748,558
Great Britain	23	11,407,084	6,200,644
Greece	1	167,479	45,000
Hungary	1	880,371	186,945
Italy	12	3,858,448	1,958,321
Netherlands	9	1,894,931	663,011
Norway	2	318,701	85,085
Portugal	2	629,368	356,486
Rumania	1	345,628	124,734
Russia	13	7,294,293	1,672,024
Poland	1	909,491	162,805
Finland	1	170,500	61,530
Serbia	1	90,870	14,600
Spain	9	2,099,664	1,502,589
Sweden	4	767,773	185,566
Switzerland	3	446,522	146,055

[1] *Statesman's Year Book*, 1864.
[2] Resultat's *Statistiques de Denombrement de 1881 Population*, also *Statistique de la France*, Vol. XIII, 1861.

POPULATION FACTS FOR THE UNITED STATES AND THEIR INTERPRETATION[1]

By Warren S. Thompson, *Scripps Foundation for Population Research, Miami University*

I feel that in many respects it is not only unnecessary but even presumptious for me to discuss this topic before such a gathering. Consequently, I shall not feel bound to keep strictly within the limits of the topic assigned me, although I shall endeavor in the course of the paper to fulfil my duty by recalling to you the most important results of the 1920 census.

The first result of the 1920 census to attract our attention was the fact that our population did not increase so rapidly during the last decade as it had hitherto. This was no surprise to those who had thought even a little about the growth of our nation during the last decade. It was very clear that the almost complete cessation of immigration for a period of about five years, the return to Europe of an unprecedented number of "birds of passage" during the first two years of the war, the general disturbance of our habits of life during the war, the mobilizing of a huge army, the destruction wrought by influenza, and, finally, the steady progress of birth control were certain to result in a lower rate of increase. The rate of increase, however, is still relatively high, being slightly over 15 per cent for the full ten-year period. Since not less than four-fifths of this increase is a natural increase, the United States probably increased more rapidly through an excess of births over deaths than any other large nation during this decade. Even Japan, about whose rapid rate of increase we have heard so much, had a lower rate than the United States. There is, therefore, nothing that cannot be readily explained in this decline in rate of increase; nor is there anything in it to cause alarm. A natural increase of 12 or 13 per cent is a good healthy increase, and certainly does not indicate any general debility among our people. It appears, however, that we have entered on a new era of population growth in the last ten years. From the first census until the Civil War our rate of increase was about 35 per cent each decade. From 1860 to 1890 (using the corrected estimates for 1870) it was close to 26 per cent each decade. From 1890 to 1910 it was about 21 per cent, and now it is 15 per cent or only about three-sevenths of what it was 60 years ago.

[1] Read at the Annual Meeting of American Statistical Association at Chicago, December, 1922.

Moreover, it does not seem likely that the percentage of increase will rise again if the present restriction of immigration is continued. The forces which have been operating in the past to reduce the birth rate are at work today, and there is good reason to believe that they will operate more generally in the future than they have in the past. Consequently we may look forward to a period of slowly decreasing rate of increase.

Another fact that impresses itself on one studying the census returns is the very uneven rate of growth of the population in different parts of the country. A glance at a table giving the rate of increase of population in the different states shows that Vermont, Mississippi, and Nevada have lost population while Maine, New Hampshire, Missouri, and Kansas have gained less than 5 per cent. Nine other states, largely agricultural in character and located in the south and middle west, gained only 5 to 10 per cent. The five states making the greatest gains are agricultural states of the far west. The three great industrial states of the east, Massachusetts, New York, and Pennsylvania, gained a little less than the average for the whole country (about 14 per cent), while Illinois just barely topped the average. Ohio, Connecticut, and Michigan gained considerably more than the average, 20.8 per cent, 23.9 per cent, and 30.5 per cent respectively. Thus there appears to have been a slight movement of the manufacturing and commercial population from the Atlantic seaboard into the East North Central States. This is shown most clearly by the fact that while New England had one-tenth of one per cent less of the total population in 1920 than in 1910 and the Middle Atlantic States had one-tenth of one per cent more, the East North Central States had gained five-tenths of one per cent over their 1910 population. It is also worthy of note that the area west of the Mississippi claimed a considerably smaller proportion of the total increase of population during the last decade than during the ten years preceding 1910, the percentages being 32.3 and 39.3 respectively.

Industrial opportunity, access to cheap or free land, and climate seem to be the chief factors determining the rate of increase in the different states. That these are the important factors in the distribution of population will be much more apparent if we turn to the data showing the growth or decline of population by counties.

One thousand and eighty-two counties having a total land area of 908,803 square miles and comprising 30.6 per cent of the area of the United States showed a decrease in their population between 1910 and 1920. Four hundred and eight other counties had an increase of less than 5 per cent. Thus about one half of the counties of the United

States, comprising between 40 and 45 per cent of the total area, either decreased in population during the last decade or remained practically unchanged. These counties are found largely in the older agricultural areas of the North and the South, although they are by no means lacking in the poorer homestead areas of the Mountain and Pacific Coast States.

The drift from the farms to the towns and cities was very rapid during this decade—more rapid than ever before—as witnessed by the following facts: (1) the proportion of the rural population to the whole fell from 54.2 to 48.6 per cent; (2) practically all this proportional decline took place in that part of the rural population living outside of incorporated places; (3) the total increase of the population living outside of incorporated places was only 800,000—almost exactly the same as the increase in incorporated places of less than 2,500; (4) this absolute increase—800,000—is just about one-third of the absolute increase in the same group during the decade 1900–1910 and less than one-fourth the increase that took place between 1890 and 1900.

Another way to make clear the trend of population growth is to point out that the territory classed as rural in 1920 increased in population only 5.4 per cent during the decade, while that classed as urban increased 25.7 per cent. In the North the rural increase was only 1.5 per cent, in the South 6.4 per cent, and in the West 25.3 per cent. The greatest absolute increase in numbers was in the South, which now has a larger rural population than the North.

Let us now consider more specifically the growth of cities. In 29 cities having over 200,000 inhabitants the rate of increase in the central cities was 25.1 per cent, while in the territory around these several central cities, the outlying parts of their metropolitan districts, the rate of increase was 32.7 per cent. At first glance it may appear that here is proof of a tendency to leave the more crowded cities and to settle in the suburbs, and when we think of the speeding up of transportation by the automobile and the improved rapid transit facilities we are inclined to think such a movement likely. But a closer scrutiny of the growth of each metropolitan area makes it doubtful whether this is the right interpretation. For one thing, a rather small absolute increase in areas outside the cities appears very large when expressed in percentage form because of the small number living in such areas to begin with. In the second place the largest gains outside the central cities appear to have been made by those districts located close to cities which had a very rapid rate of growth and where the actual political boundary of the city has not been enlarged to keep pace with this growth. (Detroit is a good example.) Suburbs built up under

such conditions are not real suburbs, for often they are entirely enveloped by the city and there is no assurance that they give relief to those who would like to live in less congested districts. We need some more accurate measure than is contained in these data before we can safely conclude that there is any definite tendency towards living in the less congested parts of our metropolitan areas. When we consider the same facts for cities having 100,000 to 200,000 inhabitants we find that the cities proper grew 30.9 per cent, while the adjacent areas grew only 19 per cent. It is probable that this difference between these two classes of cities merely indicates that these smaller cities had more space within their boundaries available for house building, i. e., were not so crowded at the beginning of the decade as the larger cities, and also that they were able to annex suburbs more easily. When we compare the growth of the whole metropolitan area of the larger cities with that of the smaller, we find that the rate of increase of the former was slightly larger than that of the latter, the percentages being 26.9 and 26.1 respectively.

If we group the urban dwellers of the United States into four classes, viz., those living in places of 1,000,000 and more, those living in places of 100,000 to 1,000,000, those in places of 25,000 to 100,000, and those in places of 2,500 to 25,000, and compare the proportions living in these places in 1880 and in 1920, we find that two striking changes have taken place: (1) the proportion living in places of 1,000,000 or more is now 18.7 per cent, while it was only 8.2 per cent in 1880; (2) the proportion living in places of 2,500 to 25,000 is now only 30.4 per cent, while it was 41.5 per cent in 1880. The changes in the two intermediate groups have not been large, a decline from 34.1 to 31.8 per cent in the 100,000 to 1,000,000 group, and an increase from 16.2 to 19.0 per cent in the 25,000 to 100,000 group. It appears from this that the exceedingly rapid growth of the largest cities has not been at the expense of the cities having between 25,000 and 1,000,000 inhabitants but at the expense of the places having fewer than 25,000 inhabitants, and especially at the expense of the strictly rural population.

There is much difference of opinion regarding the significance of these changes in the grouping of our population, especially as regards the significance of the slow rate of growth of our rural population taken as a whole, and its actual decline in many of the older settled areas.

For myself, I cannot agree with what seems to be the rather common notion that the decline or very slow growth of the rural population, due to the city-ward drift of young people, is a sign of its decadence

and constitutes a menace to the welfare of the nation. I think, rather, that it is an indication that country people are using their intelligence more and more to guide their conduct, and as such the migration of the young people is to be regarded as a normal and healthy movement. For one thing, it means that young people brought up on the farm are less willing than ever before to settle down to their life work without making a survey of the opportunities open to them. That many of them find better opportunities in the towns and cities than on the land is not surprising. In fact, it is entirely in accordance with what those of us who know something of the conditions of life and work in both city and country would expect. Consequently, I regard the slow rate of increase or even a decrease of the rural population as a sign of the exercise of good judgment on the part of country boys and girls under the present economic and social order of things. This is not to say that rural population may not decline to the danger point, nor is it to disparage rural life. We must recognize the fact, however, that when many of the good things of life, both economically and socially, are only accessible to certain groups of people there is going to be a continuous movement into these favored groups from those not so favored, and every crisis which accentuates the differences between these groups will accelerate this movement. But this is a subject worthy of several papers in its own right, and I cannot pursue it further here.

A second way in which this slow rate of increase of rural inhabitants indicates an increased use of intelligence on their part is found in the fact that the agricultural production of those counties and states which show a practically stationary or declining population has not remained stationary or become less but rather has increased. The farmer has learned to make use of more and better machinery, to manage his farm better, and to raise better varieties of both plants and animals so that it takes less of his labor today to produce as much as, or even more than, he formerly did. As a consequence not so large a proportion of our population needs to be rural as was the case a generation ago. Certainly, this is all to the good, and as long as we can secure at a fair price the food and other agricultural products we need from a decreasing proportion of our population, we ought to rejoice in the fact of its decrease rather than bemoan it. Only those who are more interested in cheap food for cheap labor than in the welfare of our rural population will begrudge the farmers the larger returns they should secure as they become a smaller proportion of the whole population. Furthermore, because of its very nature, farming is a competitive business and is likely to remain so, no matter how well organized

farmers become. This means that when boys and girls brought up on the farm see as good opportunities on the farm as in non-agricultural work in the towns and cities they will stay on the farms. But we cannot expect them to stay until they do see such opportunities. That opportunity for a reasonably comfortable life on the farm has been as great as in the city during the last twenty years will hardly be maintained by any one who knows conditions in both places.

In the third place, the slower rate of increase of the rural population is in part due to the spread of knowledge regarding methods of birth control into the country districts. As one who believes we need intelligent control of the processes of population growth as well as of other social processes, I regard this a forward step on the part of country people.

I should also like to say while speaking of the rural population and its conditions of life that a considerable acquaintance with country people has convinced me that the evil effects of cityward migration on the rural districts have been greatly exaggerated. To talk, as many do, as though only the feeble-minded or "weakly motivated" have been left behind in the country is to talk without a first-hand acquaintance with country people. No doubt cityward migration is selective in some respects, but it certainly has *not* been proved that it selects a generally superior type of stock and leaves the country with an undue proportion of poor stock. From the standpoint of one looking at the long-time processes of population growth a very strong argument could be made to the effect that the qualities of a great proportion of the cityward migrants, as manifested in their modes of life, have only a passing value to the race, while the qualities of the rural-minded stay-at-homes are of permanent value. It is at least open to question whether those people who place economic and professional success above the values of family life and biological success are contributing as much to the development of the civilization of the race as those who make less of a stir in contemporary affairs but who value home life more highly and who leave fair numbers of children to carry on. I can imagine a malignant spirit bent on the destruction of our present civilization laughing in unholy glee at those of us who become so obsessed with the importance of making a large income, or writing a book, or making a success in politics or in some other way creating a ripple in our little puddles, that we have no time or energy to raise families. I can imagine such a sprite chortling: "Oh, these *superior* humans! How they jolly themselves into believing that to be in the limelight is to achieve! If the so-called common people will only follow these self-appointed leaders not only will I not have to exert myself to

destroy this civilization, but the entire race will die out of its own accord. However, I can plainly see that the common people are going to give me trouble. They are still interested in simply living. They must be diverted from caring for homes and children, they must be turned from placing a high value on simple neighborliness, they must be made to yearn for the luxuries and vanities of life as their *superiors* now do, if they are to be destroyed and their achievements made of no avail." But enough of this, as it will lead us far afield. I only wish to emphasize the fact that the selective process going on in cityward migration is not so simple as is generally supposed; that the effects of this migration are so complicated that we cannot dispose of it merely by saying it is dysgenesic and by supposing that the rural population is in a decaying state. Furthermore, it seems to me it has yet to be proved that a civilization can survive which is substituting as its foundation the superficial processes of training which we call *Education* for those processes of training largely unconscious and traditional and, therefore, more influential, which predominate where family life is still basic and where it never occurs to people that social success and biological success are incompatible, or at least antagonistic in many respects.

Another important fact brought out by the 1920 census is that the negroes still continue to become a less important element in our population. In 1920 they constituted but 9.9 per cent of the population as compared with 10.7 per cent in 1910 and 11.6 per cent in 1900. The negroes constitute a little less than one-tenth of our population today whereas in 1790, at the time of the first census, they constituted about one-fifth. This decline in the proportion of negroes has been steady but gradual during the entire period of census taking (with only one unimportant exception, viz., the period 1800–1810). This statement holds true only if we accept the corrected estimates of the Census Bureau for the Southern States in 1870.

It is of course quite possible that the decline in the percentage of negro blood in the population is not so great as the decline in the relative numbers reported at the different censuses. But even when due allowance is made for those of mixed blood who report themselves as white persons it still appears beyond question that the negro is losing out in the competition with the whites. The absolute increase in the negro population during the last decade was the least it has been since the decade 1830–1840 when the total negro population was just about one-third of what it is now. Certainly this indicates the presence of race suicide with a vengeance.

In the cities of the North the negro has a very high death rate and a low birth rate, so that in these localities there is generally no natural increase but rather a natural decrease. Even in the South, however, the natural increase of the whites is considerably higher than that of the negroes in every state for which we have reasonably reliable data. I venture to assert that this tendency of the negro to increase at a slower rate than the whites will continue for at least another decade or two even if immigration should be entirely shut off. This opinion is based on the following facts: (1) that the proportion of the total negro population under 10 years of age is declining rapidly, more rapidly than the same age group in the white population; (2) that the negro population is becoming urbanized much more rapidly than the white population (there was an increase in the negro urban population of about 875,000 or 32.6 per cent during the last decade and a decline of about 240,000 or 3.3 per cent in the negro rural population); (3) that much of the increase in negro urban population is taking place in northern cities.

All the data available in the registration reports of the different states show that the city is far more deadly to the negro than to the white, and that the northern city is especially so. The city is deadly in two ways: (a) to the individual—witness the death rates ranging from 20 to 30; (b) to the race—witness the low birth rate generally exceeded by the death rate. Since it does not seem likely that there will be any marked change in any of these factors within the next few years, we can fully expect the present tendency of growth in the negro population to continue for some time.

It is exceedingly difficult to make any brief definite statement regarding the proportion of mulattoes in the negro population, due to the different definitions of "mulatto" adopted by the census at different periods, as well as to the inherent difficulties of making such an enumeration. Suffice it to say that there has undoubtedly been an increase in the proportion of negroes having mixed blood during the last fifty years. Since this fact seems well established it does not appear unwarranted to assume that the total increase of negro blood is no greater than the increase of negroes reported by the census even though a few people with some negro blood may have been reported as whites.

The return of great numbers of immigrants to their native lands and the practical cessation of arrivals for several years naturally resulted in a very slow increase in the foreign-born element in our population. The absolute increase was about 367,000, which amounts to only 2.8 per cent. The increase between 1900 and 1910 was 30.7 per cent.

The same countries which were sending a preponderating proportion of our immigrants in the decade preceding 1910 were still doing so during the last decade. The proportion of foreign-born from northern and western Europe grows ever smaller, and that from eastern and southern Europe grows greater. To attempt to make a brief statement regarding the significance of this change is hazardous, for there are a great many factors in the situation to take account of. If it is true, as I believe it is, that migration whether within or across national boundaries is largely determined by the economic opportunities available for exploitation by the prospective migrants in the localities to which they go, then this change in the source of our immigrants means that people living in western Europe who formerly saw opportunities here no longer see them, and that people living in eastern and southern Europe with different and lower standards of living are those who now find opportunities open to them here. The less attractive the opportunities our country offers to immigrants, the lower will be the economic classes from which these immigrants are drawn. Since the people of eastern and southern Europe are in general poorer than those of northern and western Europe, it is but natural that the opportunities here would attract the former after they have ceased to make much appeal to the latter. In the future they will undoubtedly be attractive to Asiatics after they have ceased to attract the Italian, the Slav, and the Jew. The changes in the sources of immigration afford a sure indication of the value attributed to the economic opportunities in our country by the different peoples who are free to come. We are already beginning to ask ourselves whether we want the economic conditions here such that only peoples who can and are willing to live very cheaply will care to come. In the near future we must give this whole situation much more serious consideration than we have in the past.

Another class of population facts of great interest and significance, although not contained in regular reports of the decennial census, is the special study on the size of families made by the Census Bureau in connection with the birth statistics for 1920. Among other valuable classifications of the births we find one made according to the occupation of the father. This classification shows that the women whose husbands are mine operatives have borne and have still living the largest number of children of any class which is not clearly affected by the ages of those belonging to it—the average number born being 4.3 and the average number living being 3.5. That wives of foremen, overseers, and inspectors in mines should have slightly higher averages, 4.6 and 3.9 respectively, is not surprising because they are miners

who have risen to their present positions through years of service and consequently are older, on the average, than the operatives.

The women whose husbands are engaged in professional service have borne and have still living the smallest number of children, the averages being about 2.2 and 2.0 respectively. Only the wives of clergymen, of all those listed in this group, have borne more than 3 children on the average—their average being 3.3 born with 3.0 still living. Wives of farmers, next to the wives of miners, considering only the larger groups, have borne and have still living the largest number of children—the averages being 3.8 and 3.4 respectively.

The wastage of child life is naturally greater where births are more frequent and living conditions are poorer than where births are less frequent and living conditions better. Miners' wives have lost, on the average, 0.7 of a child, farmers' wives, 0.4 and professional mens' wives, 0.2. One could go through the long list of occupations and not find an exception to the general statement that people in the more favored economic classes have a lower birth rate and a lower wastage rate of child life than those in the less favored classes. If further proof is wanted of the tendency to which Professor Ross has done more than any one else to call our attention, viz., the tendency of the older stock and of those people who have risen into the higher economic classes to reproduce less rapidly than the newer immigrants and those in the lower economic classes, it is to be found in other tables contained in the study made by the Census Bureau. For example, 32.4 per cent of all white mothers of 1920, born in the United States, had borne but 1 child, 21.8 per cent had borne but 2 children, and 14.7 per cent had borne but three children, i. e., 69 per cent of all white mothers of 1920, born in the United States, had borne 3 children or less, while of mothers born in Italy, only 41.8 per cent, had borne 3 children or less, and of mothers born in Austria (including Austrian Poland) only 45.4 per cent had had 3 children or less. Of course certain allowances need to be made because of differences in age and length of time married, which are not taken account of here; but even when this is done it is clear that these southern and eastern Europeans are breeding much more rapidly than the natives.

There are many other interesting facts set forth in the tables of this study, but time will not allow me to cite them here. Those who have not happened to see this study can look forward to a pleasant and profitable hour in its perusal.

It may be questioned whether the increase of tenants on the farms is primarily a population fact, but its importance will not be questioned. Every one is aware that farm tenancy has been increasing very rapidly

since 1880. It had definitely begun to slow up, however, by 1910, as the census of that year showed, and the increase during the last decade was still lower, being only 1.1 per cent. Thirty eight and one-tenth per cent of all our farms are now operated by tenants. I will confess at once that I do not feel at all certain what the significance of this decreasing rate of increase is. It may and probably does indicate the operation of several different forces. For one thing, it seems likely that the prosperity enjoyed by the farmers from 1915 to 1919 enabled a number of young renters to make a first payment on their farms somewhat earlier than they could have done under normal circumstances. The fact that fewer farms operated by owners were free from debt in 1920 than in 1910 seems to lend some color to this explanation, although this fact may be due to several causes of an entirely different sort. In the second place, it may mean that the quality of land which will yield a return sufficient to make both the landlord and tenant feel that it is worth renting is already pretty well in the hands of tenants, and farm tenancy can be extended only slowly as the standard of living of the operator is adjusted to a lower plane commensurate with the smaller return from poorer land. The New England and the Middle Atlantic States, where much of the land is rather inferior and where the opportunities to enter non-agricultural employments are most numerous and most easily taken advantage of, show a decline in number of tenant farmers. Again, it may be that with the improvement of schools and roads and the consequent increase of taxes landlords are finding it more profitable to transfer their holdings into something less easily taxed and therefore more profitable, so that the tenant who desires to become an owner is finding some of the obstacles to accomplishing his desire less difficult to surmount. In general this does not seem likely to be the case as the country grows older and land values increase, but I have come across some specific instances where landlords were willing to make quite favorable terms with their former tenants in order to be relieved of their land holdings at a fair price. If I were to prophesy I should venture the opinion that tenancy is not likely to increase very rapidly in the near future, because I think it rather doubtful whether much more than two-fifths of our land in farms will support tenants at a standard of living such as they are likely to demand at the present time and also yield a return to the landlord sufficient to make it profitable to keep the land. Of course there are many factors that might conceivably change the whole situation within a few years. I base this opinion partly on a consideration of the general economic forces at work and partly on personal observation in certain districts where there is a great deal of tenancy at

the present time. In some districts that I know personally I should not be surprised to see the percentage of tenancy decrease rather markedly during the next decade or two.

In order to see whether I could detect any relation between tenancy and the growth of population I made comparisons between the birth rates of the "rural parts of the registration areas" of those counties having the highest percentages of tenancy and those having the lowest percentages in several states. I have also tried to make comparisons for the same purpose by using census data on proportion of children in the rural population of counties having markedly different percentages of tenancy. It would only weary you to quote these figures here; it will suffice to say that nothing conclusive is shown by them. It seems likely, however, that more detailed studies such as would be possible if the Census Bureau were to give us age groups for the population living in incorporated places of less than 2,500, or for the real farm population, would throw light on the question of whether the farm tenant has a larger family than the farm owner.

It is interesting—whether or not it is profitable is another question—to speculate upon the effects on population growth of the greater cityward migration of women than of men. That it is greater is shown by the fact that the ratio of males to females in the rural population is 108.0 to 100.0, while in the urban population it is only 100.4 to 100.0, in spite of the fact that most of the immigrants, among whom the males very greatly predominate, stay in the cities. Thus a great many native-born girls find themselves in the cities without the opportunity of meeting men whom they would consider suitable mates. A natural result of this situation is that the percentage of unmarried women in the child-bearing age groups is higher in the cities than in the country. In 1910 (the data for 1920 are not yet available, but there is no good reason to believe that the percentages will be materially different) only 26.9 per cent of all urban females 15–24 years of age, and 78.8 per cent of those 25–44 years of age, were married, widowed, or divorced, while the corresponding percentages for rural women were 35.6 and 88.0. It is interesting to note in this connection that the native-born women of native parentage in these age groups are more generally married than the native-born women of foreign or mixed parentage. This is true for both the urban and the rural population. In the urban population 26.9 per cent of the native white women of native parentage 15–24 years of age were married, widowed, or divorced, while only 18.1 per cent of the native-born women of foreign or mixed parentage were. In the rural population the percentages were 35.6 and 23.5 respectively. In the age group

25–44 the corresponding percentages were 78.6 and 71.2 for the urban women and 87.9 and 82.6 for the rural women. Apparently the native-born daughters of foreign or mixed parentage find the adaptation to home life harder to make than the native-born daughters of native parentage. I know of no special investigation made to ascertain the reasons for this fact and therefore cannot speak with authority. I would suggest, however, that the native-born girls of foreign and mixed parentage see so many unlovely features of home life during their impressionable years that in many cases they prefer the freedom of single blessedness to the overlordship of a man with Old World ideas of woman's sphere, who probably also has considerably less schooling than they themselves.

There are many other important and interesting population facts which might be mentioned here, but time does not suffice. There are still others of great importance, probably of more importance than many of those cited, such as those in Professor Glover's Life Tables, which are not yet available to those not in the inner circles. Then there are some one would like to present which have not been collected, and some which have been collected but which have not been and will not be tabulated. Progress is being made, however. We are getting the census data for 1920 earlier than we did those for 1910, and by the time another census is taken we shall probably get some entirely new population facts to ponder over.

THE MEASUREMENT OF CONCOMITANCE OF VARIATION: PROPOSED INDEXES OF VARIABILITY AND CORRELATION BASED UPON LOGARITHMIC CURVES AND HAVING REFERENCE PRIMARILY TO TIME SERIES

By G. P. Watkins

Introductory general considerations. *Basic series of logarithms and differences. Index of variability:* An index based upon the average of logarithmic chain differences. —Adjustment for trend. *Index of correlation:* The simplest case.—Adjustment for difference in average variability.—The denominator of the correlation fraction. —Graphic illustration with especial reference to bowed trend.—Correction of the numerator of the correlation fraction for different range and incidence of variations. —Reduction of the correlation fraction to a coefficient. *Actual indexes* for certain grain prices. *General considerations* regarding coefficients of correlation. Appendix table.

PART I

I. INTRODUCTORY GENERAL CONSIDERATIONS[1]

It has long seemed to the writer that a method of determining the degree of correlation between two "historical" series of quantities could be based upon the comparison of curves, or upon underlying graphic and geometrical conceptions, with results at least as satisfactory as those obtained by a use of the Pearson coefficient that requires supplementary and extraneous calculations and assumptions designed to eliminate the influence of difference in trend upon such comparisons. He has likewise long felt that logarithmic curves, or the manipulation of logarithms in ways suggested by their potentialities for graphic analysis, afford the means for developing such an index.[2]

The comparative study of curves or of numerical series from this point of view involves consideration of their fluctuations or the degree of their variability.[3] The devising of an index of variability is of

[1] The author has felt the need of criticism of this article, especially by mathematicians, and has sought and received such aid. To mention names, however, would perhaps imply a degree of support and finality for the methods proposed which is not claimed for them. Not only are more secure proof (or disproof) and elaboration of the mathematics involved highly desirable, but to promote their achievement is the chief justification for publishing the article.

[2] There are several species of correlation, of which the one referring to parallel changes in time may conveniently be called concomitant variation. The type of correlation to which the Pearson coefficient primarily relates is perhaps best represented by the connection between various dimensions of the body as manifested in a large number of individuals. Time is not involved.

[3] It is unfortunate that the term "variability" has a familiar application (doubtless biological in its origin) different from that of the text, though there is more than a mere analogy between the two uses of the word. But the term "fluctuation" is not a satisfactory name for the phenomena referred to because elements of variation (cyclical movements) that are not fluctuations, strictly so-called, are

considerable independent interest as well as an incident of the proposed method of measuring degree of concomitance of variation.

Of the reasons for basing the method upon logarithms no more need be said than that, first, only so is it possible to obtain perfectly relative quantities—such as are relative, so to speak, within themselves[1]—and, second, only logarithms will stand the manipulation necessary to the method proposed.[2]

The relativity of the method (or the use of logarithms) implies that the original numbers refer to an absolute zero, or a true lower limit (though perhaps not necessarily an absolute limit) upon the degree of downward fluctuation. It would not be strictly applicable, for example, to a series showing the net income of a corporation for a term of years, because such net income is merely a difference between gross income and various deductions, and may easily be negative. Zero in this case is in no sense a limit to the range of variation. Similarly, quantities expressed in terms of thermometric degrees Fahrenheit could not be directly used in the sort of computation proposed.[3]

Fluctuations may be conceived and measured in two different ways, either as deviations from an average or norm, or as differences between successive items in a series. While there is no need in the present connection to determine whether the one or the other conception has greater general validity, to assume that fluctuations are best measured as differences between successive items in the case of time series, where there is bound to be some degree of interconnection between successive items and, for shorter or longer periods, some degree of independence

included, and because, by reason of the fact that the series will doubtless be constituted by more or less averaging, short-time fluctuations will usually not be registered in the series as used. In fact, the measurement of variability in question is not designed to deal with fluctuations in any comprehensive sense, but confines itself to the course of the curve (or the series) as constituted for purposes of comparison. If the basis is the yearly average, or the monthly average, obviously most actual fluctuations (which are naturally thought of as inconstant and for most purposes insignificant variations) are smoothed out. There will be occasion again to refer to the fact that the indexes proposed in this article relate to the properties of the curves (or series) as constituted. How the series should be made up is of course not an unimportant matter, but it is a matter for separate statistical consideration, with reference both to the problem in hand and to the character of the data, and is not included in the subject of this article.

[1] For example, a 50 per cent increase is not equivalent to two 25 per cent increases. Likewise, it is obviously not correct to assume that a 50 per cent increase and a 50 per cent decrease are equivalent to each other for purposes of addition and averaging, or in fact for almost any purpose, for the same reason that a 100 per cent decrease is not comparable with a 100 per cent increase, or in fact with any other finite per cent increase.

[2] Illogical results in price index numbers have been largely due to the fact that per cent relatives will not stand the manipulation to which they have been subjected.

[3] In other words, it is not claimed that all changes and fluctuations should be interpreted relatively to the magnitude of the fluctuating absolute quantities. In addition to cases such as those above mentioned, there are doubtless also cases calling for special consideration where an upward fluctuation is subjected to an elastic check as it approaches a saturation point or upper limit. But if practical considerations call only for a choice between two alternatives, a relative or logarithmic and an arithmetic or absolute method, the presumption is in favor of the former.

of the average and also of the smoothed curve (or of the trend), has practical as well as theoretical advantages. On the practical side, since in time series the average is not constant and is subject to secular and other changes, it is better not to have to rely upon some more or less arbitrary method of determining what the particular value is from which a deviation should be measured. On the theoretical side, while it is true that there is more or less resistance to movement further away from the trend when the preceding item is already well to one side of it, so that a reaction is more to be expected and may well count for less in proportion to the size of the differences between successive items than such further movement away from the trend, it is also true that the trend level or the center of gravity of the series may, and very likely is, for the time being different from what it is before and after any considerable succession of decided deviations having the same sign. For example, an upward movement of prices due to special war demand or to inflation means that the center of gravity from which deviations, or at least short period fluctuations, are properly measured is itself changed, and changed in a way that would not be adequately reflected in any moving average series. For the purposes of this article it is consistently assumed throughout that fluctuations are properly conceived and measured as differences between successive items. The analogy of the latter with chain relatives may be helpful to an understanding of this detail of the method used. It also suggests "chain differences" as a convenient name for this element in the computation.

That the chain differences are at least as significant for curves representing economic and social time series as are deviations from the trend may be made clearer by illustration. The increase of population in a particular year is derived from the population of the preceding year. If the casualties and deprivations of war subtract large numbers of adults from the population, the normal increase will by reason of this situation be less than before. Of course for some purposes what is normal may be defined differently. But, apart from attempts to measure the effects of the war itself, the simple projection of a curve based upon increases in the period previous to the war, and the determination of the character of the particular year's movement by measuring the deviation from such a trend, is not appropriate. A smoothed curve of aggregate population will not serve as a norm from which to measure the strength of influences affecting the natural rate of increase as such. Most comparisons of contemporary social changes with population will also probably be affected by the war in a way comparable with the effect on population. It might be argued

from this fact that comparison by way of the measurement of deviations from a trend is correct. The unexpressed premise of this argument, however, is the assumption that the conformation of the two trend curves is the same. It is well to avoid such an assumption, as the use of chain differences does.

To use an economic illustration that is so broad in its application that it is in fact more than an illustration: Prices are causally related to immediately preceding prices rather than to a projected average for a number of years. A merchant fixes his charges mainly on the basis of recent experiences and conditions. A manufacturer formulates his prices upon the basis of his costs, though in part with regard to what he can get according to a judgment of the urgency of the demand, which also derives from the immediate past, though referring to the future. Chain differences are probably in general more significant for economic data than deviations from an assumed trend, except so far as the two may possibly be so handled as to be equivalent to each other, and also except for special purposes.[1]

If, by the logarithmic method, the series of quantities and relations to be considered can be reduced to single-number indexes, curves themselves can, at least in most cases, be dispensed with or used only for purposes of illustration. This need of condensation is imperative where a considerable number of series are to be compared. The construction and reproduction of curves may involve prohibitive expense where the figuring of indexes, even by a somewhat complicated method, would not. There is, also, no room for arbitrariness in the comparative reading of numerical indexes, as there is bound to be when numerous and complicated curves, especially arithmetical curves, are compared. But the comparison of actual curves might also have its advantages.

II. BASIC SERIES OF LOGARITHMS AND DIFFERENCES

The figures used for purposes of illustration and test of the methods proposed are the prices of the four cereals, wheat, rye, corn, and oats. The basic absolute figures are the annual average prices at Chicago for each of the four grains for a period of 30 years. Barley is omitted because satisfactory annual average prices for the full period cannot be obtained.

The fundamental logarithms are (1) those of each annual average price for the grains in question for 30 years.[2] These are hereafter referred to as series 1.

[1] Chain differences directly computed upon unadjusted series include an element of trend, the elimination of which is provided for in the following pages.

[2] The figures are of course for crop years rather than for calendar years, but it is considered best to

The effect of trend upon the comparisons to be made should be eliminated. This can be accomplished by deducting from the last logarithm of series 1 the difference between it and the first, and from each successive intervening logarithm its corresponding element of trend, *i. e.*, 1/29th of the total difference for the second logarithm, 2/29ths for the third, and so on, the denominator of the fraction used in obtaining the figure to be deducted being one less than the number of original logarithms and equal to the number of intervals (increases or decreases). But the same result can be arrived at more directly by operating with the same constant upon the differences between successive items, and such chain differences are basic for the whole scheme of indexes under discussion.

Hence the next is (2) a series of chain differences; that is, the logarithms for successive years for the same grain are each one subtracted (algebraically) from the one following. These differences may of course be either *plus* or *minus*.

The next series is derived with reference to eliminating trend, which is taken to be represented by the difference between the first and last items of series 1. The constant above described (supposing the trend to be positive) is subtracted from the positive differences and added to the minus differences. If the trend is downward the process is reversed. This process yields (3) a series of chain differences adjusted to eliminate trend. The items of this series stand for the increases and decreases in price from year to year after eliminating the element in such movement as is, for the purposes of the present computation, assumed to be due to trend. The limitations and advantages of this method of disposing of trend are discussed in later sections. An index of variability is derived from this third series, and for such a purpose by itself no further series are necessary.

The comparison of two curves with reference to determining the degree of correlation between their series requires their equalization as regards variability. Such a computation proceeds from equalized chain differences. These may be derived directly by multiplying the preceding series of chain differences by a fraction which increases or decreases the variability of all the series to a common level or to a single average variability. The denominator of this fraction is the sum of the adjusted chain-difference series to be equalized, and its

use a single crop year, that of wheat, beginning July 1, for all the grains, instead of comparing prices for different years, for example, prices of corn for years beginning November 1 with those of wheat for years beginning July 1. There is doubtless a degree of adjustment of prices, by way of foreknowledge, to conditions under the coming crop, so that the delimitation upon the basis of time of shipment of the new crop is not valid absolutely; and the causes of high or low prices more or less common to two or more crops are operative in the same month of the calendar year rather than at the same stage of the crop year.

numerator is any convenient constant. The resulting series (4) is the equalized chain differences. This type of series is adjusted both for trend and for variability.

This fourth series is not of use in deriving an index of variability—in fact, it follows upon it and destroys the characteristic degree of variability of the series to which it is applied; but it is necessary for reducing the two variabilities of two series to the same level preparatory to the test for correlation. The equalization of variability may be made in either direction, either by enlargement or by reduction. A possible rule is to make the adjustment by choosing the series showing the largest sum of chain differences as a standard and raising the values of the other series to this one. But it is convenient to take further advantage of the fact that the basis of equalization is arbitrary by equalizing to the number, next beyond the largest sum of chain differences, that begins with a single digit and for the rest is composed of 0's. By this means the final process of division by the sum of chain differences to obtain the index of correlation is simplified.

From each pair of series of adjusted and equalized chain differences, that is, from each pair of the fourth kind of series, is derived (5) a series of differences between corresponding items, for example, between the wheat and the oats chain-difference figure for each year. This is done for each two series to be tested for correlation. The number of such series derived for such comparison depends upon the number of combinations, and for the four grains is six. These series of differences between corresponding items of the preceding series are referred to in the following pages as correlative differences.

Further manipulation of the series is necessary, however, in order to provide for the effect, upon the foregoing series of correlative differences, of differences in variability not provided for in reducing the chain differences to the same average degree of variability. Such a correction needs to be applied to the sums of correlative differences. To facilitate the obtaining of a corrective figure (6) the adjusted and equalized chain differences should be arranged in the order of the magnitude of the items. This may be considered the sixth series for convenience of reference, although it is not necessary for purposes of computation that it be independently set out. These are conveniently distinguished as graduated differences.

From the foregoing series of graduated differences are derived differences which are parallel with the correlative differences. These are (7) differences between the series 6 items as paired by their arrangement in the order of magnitude. Signs are disregarded in the computation but are useful in checking. Only the sums are employed in

computing indexes. These series may conveniently be designated the coordinal differences.

It is worthy of note that the computed series described above are, to a great extent, self-checking, and that much work and time are saved by reason of that fact.[1]

Negative logarithms[2] should not be included in any of the series compared by the methods here proposed. They will not ordinarily occur and can easily be avoided by shifting the decimal point throughout the original or absolute series so affected. Moving the decimal point, for example, one place to the right, does not affect the differences between logarithms, and therefore does not affect the results obtained by the methods used.

These groups of series of logarithms constitute the basic figures in computing the proposed indexes of variability and of correlation. They are shown in a table appended to this article in order to be available for reference.

It is worth noting in the present connection, since it is not always specified in the following discussion, that all the sums used in the computation of indexes are to be taken disregarding signs. Algebraic sums, however, will occasionally be found of use in checking.

III. INDEX OF VARIABILITY

An Index Based Upon the Average of Logarithmic Chain Differences. —Variability is the aptness or tendency of a series of quantities or values to change from item to item, or, more specifically, to change irregularly, either as to the direction of the changes or as to their size. Variability relates to a single series and involves no direct comparison between two or more series, while correlation does involve a comparison of two series. The construction of an index of variability is of course much the simpler process.

[1] The starting point is average prices already computed and checked. The series of logarithms of these prices must be checked by repetition of the work or by reading back from the logarithms to the absolute numbers. The sum of the plus differences of the second series must differ from the sum of the minus differences by the difference between the first and the last items of the first series. The sum of the plus differences of the third series must equal the sum of the minus differences. This is likewise true of the fourth series. The equalized logarithms of the fourth series are correct if the sums of these chain differences of all the series number 4 in the same set are identical and equal to the denominator selected. The sum of the fifth series, or of the correlative differences, is equal to the sum of the chain differences from the two series which as paired for deriving the correlative differences have unlike signs, *plus* the difference between the sums of correlative differences where the signs (of the corresponding items in both series) are the same, one of these sums being taken for cases where the chain differences of one series are all less than for the other, and another sum for reverse cases where they are greater. The check for the fifth series is not simple, but even this is time-saving as compared with recomputation in detail, and probably also offers better insurance of correctness. The sixth series is merely a matter of arrangement, with or without copying, of the fourth series. The seventh series checks by way of the equality of the sums of plus and minus items, where signs are attached according to the direction of the difference between the items from which this series is derived.

[2] Strictly logarithms with negative characteristics.

The proposed index of variability makes use primarily of the differences between the successive logarithms of the given series of absolute numbers. For this purpose the series of chain differences should be adjusted to eliminate trend. This is the series numbered (3) above.

The reason why this and not an unadjusted series should be used need not be explained in detail. It is sufficient to note what effect an extremely pronounced upward trend would have on such chain differences; that is, it would first wipe out minus differences and then be a net contribution to the sum and average of chain differences, and thus to apparent variability. It is true (but irrelevant) that in a series showing but a slight element of trend, the elimination of that element might have no important effect upon registered variability.[1]

These differences of the third series are added together without regard to signs, and an average is obtained. This sum is the total vertical movement of the logarithmic curve exclusive of trend, and the derived average is an index of variability; that is, various series containing the same number of terms and similar in other respects might be compared, and their ranks as regards variability determined, directly from this average.

The absolute number corresponding to this average logarithm is unity *plus* a decimal fraction.[2] The absolute number is a ratio because the difference between the logarithms of two absolute numbers when read back into numbers is the ratio of the larger to the smaller number. It is the ratio of the average of the greater to the average of the lesser terms of each of the pairs of logarithms compared by way of the chain differences.[3] The decimal fraction (or the difference between unity and the ratio in question) may therefore be read as a per cent index; for example, if the ratio is 1.14, the index is 14 per cent. All the chain differences being taken positively, the per cent will always be positive.[4]

[1] With regard merely to obtaining an index of variability by itself, it is doubtless possible to work with chain differences not adjusted to eliminate trend, since it appears that the adjustment can be made upon the sum of chain differences derived without prior adjustment of the basic logarithms. Such procedure would need to take account of the excess in number of plus over minus differences (or vice versa) and would further need to treat specifically items of which the sign would be changed by the detailed adjustment, and would employ the net total trend figure (difference between first and last basic logarithms) modified with reference to these two points to correct by addition or subtraction the sum of unadjusted trend differences. The method is evidently complex, and there could be some possible economy in its use only where there is no intention to derive correlation figures.

[2] It is mathematically possible, but it will seldom occur in statistical practice, that the whole number be 2 or more.

[3] Because of the nature of logarithms and because of the requirements of the relativity of the method, these are all *geometric* averages.

[4] Algebraic manipulation of the quantities involved will show that the process of obtaining an index of variability is equivalent, as regards what happens to the original absolute numbers, to obtaining the nth root (n being the number of terms in the series) of the product of certain terms divided by the product of certain others, the total number of terms involved in the product being also n, some of the

As indicated, this 14 per cent is the ratio of the range of the variation to the values for the lower boundary of the range. It might be convenient by manipulation further to reduce the figure to express the relation of the range to the average value of the series, or to express the relation of the average variation on each side of the average value of the series to that average. But the further computation is not necessary, and it may be doubted whether any gain in significance would result. If the index were so computed that 100 per cent would mean the extreme mathematical limit of variability, such a method would perhaps increase the tendency to assume that a difference of one unit had the same value at different points and that there would, abstractly, be an equal chance of the result falling at any point on the scale. The conception of elasticity in variation is not in harmony with such an idea, nor with the use of such a figure as would increase the likelihood of such misinterpretation.

It will be noted that any manipulation of the logarithms that leaves their chain differences unchanged leaves unaffected their availability for computing the variability index.

The variability figure obtained as above described is a generally available index. It may be used without question as to its comparative value alongside of other similarly computed ratios. It is comparable directly with any similarly computed index regardless of the number of instances used, except, of course, with reference to the adequacy of the sample, and regardless of the character of the original absolute series. For example, the variability of the prices of wheat from 1887 to 1917, as expressed by such an index, may be compared with the variability of the annual birth rate in China in the sixteenth century, supposing that the facts can be ascertained and supposing, perhaps, that there is occasion for making such a comparison.

The similarity of computation referred to, it should be noted, supposes comparable time intervals, that is, totals or averages for years in all cases, or for months, or for days, or perhaps, for example, high or low prices by days. The number of items in two series compared with reference to variability need not be the same (but for correlation they should be). The intervals should be the same and

items of the series, however, disappearing by cancellation and others entering into the computation twice. But with the first and last values made identical by the adjustment for trend, these also either cancel out or enter twice, and n is equal to the number of chain differences and one less than the number of items in the original series. Any item, however, may enter twice or be cancelled out, as the case may be. Two chain differences of the same sign involve a cancellation, and of opposite sign a duplication, of the intermediate value. Perhaps by reason of this condition some simplified formula for deriving an index of variability could be obtained. But the individual chain differences are needed for the comparisons involved in the computation of a correlation index, hence nothing would be saved by a short cut that leaves them out.

they should both be numerous if periods of unequal length are to be compared.

Adjustment for Trend.—The method of adjusting the figures for upward or downward general trend in the original series preparatory to obtaining an index of the variability of the series calls for some further consideration.[1] The adjustment is made by assuming that the difference between the first and the last logarithm of the unadjusted series of logarithms represents the trend. This method amounts to subtracting from the figure that represents the total vertical movement of the logarithmic curve any net movement away from the level of the curve's starting point.

The effect of this method of adjustment for trend may be better understood by supposing it applied to a curve with very few determining points. In the extreme case, that is, if there are only two points, the entire change in value is treated as trend. Of course, such a "curve" would be of no use for purposes of statistical comparison. The effect of dealing with trend in the way described, instead of attributing some of the net total change to fluctuation, becomes negligible if there is a sufficient number of determining points or items in the series.

Theoretically, it might be desirable to subdivide the first and last chain differences into elements of fluctuation and of trend, but there does not appear to be any simple way of doing this without making arbitrary assumptions that also complicate the calculation. It should be noted, especially, that the element of trend in a particular first or last chain difference may often be negative, so that attributing some positive portion of the difference to trend and the remainder to fluctuation would not be legitimate. The inexactness of the adjustment is in effect an average element of error in each chain and correlative difference. This element may be either plus or minus, and it diminishes in relative importance with the increase in the number of items in the series. It may, therefore, be permitted to lose itself in the statistical averages into which it enters.

[1] The course of a curve may for statistical purposes be analyzed into three elements, namely, fluctuation, cyclic movement, and trend. A general term for all three, with a qualification as regards its strict applicability to trend, is variation. In the text trend is not regarded as an element in variability. A cycle is regularly recurrent, seasonal variation being the best example of cyclical movement. Trend is secular and not recurrent. But what may for practical purposes be, or may within ordinary periods of observation which are necessarily more or less limited appear to be, trend may be seen to be cyclical movement when the period of observation is extended. Fluctuations are irregular both as to extent and duration, and pertain to comparatively brief time intervals.

For the purpose of the present article the conception of trend is simplified and completed cycles are lumped together with fluctuations, while any element of uncompleted cyclical movement is treated as a part of the trend. Such simplification of the analysis is adapted to the present calculation. The method of deriving a trend line by smoothing the curve through the use of a moving average or of fitting a curve by mathematical methods serves different purposes.

The adjustment for trend is unaffected by whether or not the trend in the period used may have been upward part of the time and downward part of the time in a way to make the net upward general trend in effect a resultant of different trends for different portions of the period. Of course if the assumption that the true quantitative significance of the change is relative is not completely borne out, so far the method of adjustment may be imperfect, although even so, probably not open to practical objection in the sense which implies that the objector is able to offer an alternative that works better.

The purpose of the adjustment is not to arrive at the conformation of the most probable trend curve (or line) in evidence in the series, but only to eliminate the effect of trend upon the computed indexes. It is not alleged that the method employed accurately represents any constant trend that the curve so treated may have. But the adjustment is handled without arbitrariness and according to the best evidence, not involving the "personal equation," that the figures themselves present.

The adequacy of the adjustment in question for the purposes of the present article depends upon its bearing upon the results of the mathematical computations made and not necessarily upon the conformity of the assumed trend to the (apparent) true trend, or the "fit" of the logarithmic straight line to the series. In connection with the computation of the coefficient of correlation, in particular, it will be seen that abnormality in the assumed trend as regards its course between the first and last chain differences is balanced by other elements in the computation, the correction being thus, in effect, itself corrected. With reference to the variability index—and with reference to the correlation index also—the only place where the assumption regarding trend makes any difference is at the beginning and the end of the series. If the true trend line, whatever that may be, cuts the first and the last chain difference at a different point from the assumed trend, there is so far an element of inaccuracy in the method.

The adjustment for trend just described should be regarded as sufficient at least for the limited purpose of deriving an index of variability. In fact, such an index may by definition be made to refer to the chain differences shown after eliminating the net upward or downward movement intervening between the first and last values. The index of variability may properly be deemed to express the degree of indirectness, or of "lost motion," in the movement from a given starting point to a given terminus, and the question of the representativeness of these first and last values may be considered immaterial for the computation of an index of variability for the curve as shown.

While it would be desirable to have the first and last values of the varying series at representative levels, that is another matter, and is not necessarily involved in the computation of an index of variability for the given series. In this sense a series of only two items has, or shows, no variability.

The reliability of the index of variability—in the sense in which it should correctly represent the variability, not merely of the figures actually used but of that kind of figures in general—of course depends upon the adequacy of the sample taken. The variability of the figures actually used appears to be correctly expressed. The statistical significance of the index may, nevertheless, be greater or less according to the number of items used and according to other characteristics of the figures that should be known to the statistician using them.

(*To be concluded*)

EXPERIMENT AND STATISTICS IN THE SELECTION OF EMPLOYEES

METHODS USED IN THE SELECTION OF MACHINE OPERATORS IN A CLOTHING PLANT

By Harry A. Wembridge

One of the largest items in the expense of running a modern plant is the selection and training of the workers. Not only is this true of the executives, but it is also true of the operatives of the less skilled type. Although various figures have been given of the cost, it is doubtful if there is any sound way of disentangling all the elements that go into this cost; but it is generally accepted that in most manufacturing institutions it runs into hundreds of dollars per worker. Therefore any method that would tend to eliminate the number of unsuccessful selections would be of considerable saving to any industry, not only in dollars saved on training expense but also in greater production and less wastage of materials.

There are several well-defined methods of hiring new employees. The simplest is that whereby the foreman of a department in need of new workers interviews the applicants and has full authority to hire and to discharge as he sees fit. As industry is growing and becoming more functionalized, this method is falling into disuse except for the smaller industries and is giving way to the system of having an employment department made up of especially trained persons whose business it is to employ the workers for all the different departments, as need arises. A still further refinement is to provide a school or training department where the new employee is sent to be definitely trained before he starts at his regular job.

In the Clothcraft Shops of the Joseph and Feiss Company, Cleveland, Ohio, where the following studies were made, the company established some years ago a vestibule school in which applicants are trained to operate power machines and schooled in the organization of the shop. After this course they are sent to their particular jobs under special instructors. The problem then arises as to how to eliminate those applicants who would not make good in the shop, and even those who would not warrant the expense of training in the vestibule school.

The method of payment used in the Clothcraft Shops is that of piece rates with bonuses for a certain standard of quantity and of quality. The standard of production is determined by time studies on the basis

of which a standard or required amount of work is set up, and this same standard is applicable to all workers. These standards have made it peculiarly easy to make an accurate comparison of the value of different workers. By the simple method of comparing the amount and the quality of work done with the standard set up, one is able to gage the relative efficiency of operatives. But the result of such comparisons only demonstrated the fact that such knowledge of the operatives had come too late. The great variation in the efficiency of different operatives made it imperative to reassign or even to eliminate some of the more incapable before they had wasted time, both for themselves and for the industry. Therefore, if this rearrangement were bound to come, why should it not come as far as possible, for the benefit of both the worker and the industry, at the very beginning of the employment period?

It might be suggested that if only applicants who had had previous experience in the industry were selected it would raise the general level of efficiency of the operatives and insure a higher standard of work. This did not prove to be the case. Judging from the standpoint of actual production, the results were slightly more favorable to workers who came without previous experience. This did not manifest itself, however, until after the learning period had been gone through by the inexperienced workers. This somewhat unexpected result was laid to several possible causes, all of which might function together or separately. In a highly organized shop it is probably true that the methods have become so individual and diversified that no experience elsewhere really fits the new situation. Or the old habits may fit the new situation only in so far as the effort to unlearn the old and readjust to the new would introduce a handicap instead of a help. However the results might be explained, from an unselected sample of 136 experienced and 195 inexperienced workers it was found that previous experience was no guaranty of production in our shops, and indeed was practically negligible either as a positive or a negative factor in selection.

Another theory which followed this one as a logical sequence was that if previous experience was not a reliable guide, perhaps present dexterity would be the most direct way of selecting machine operators, provided an accurate method of testing mechanical dexterity and muscular coordination could be devised. Such a test was developed in the laboratory of an eminent psychologist and was installed. It consisted of a steel frame in which were three holes, the entrances to which were raised above the frame; through these holes the applicant was required to insert a steel rod as rapidly as possible.

There was an automatic register of the times the rod was successfully inserted according to a given pattern of movement. In a specified time, therefore, the applicant's skill, both with his right and with his left hand, was measured. Since left-handed persons are valuable in certain kinds of work in the shop, but since applicants almost invariably refuse to admit left-handedness when they are asked, the test was of a certain value in disclosing possible left-handed operatives. But beyond this there seemed to be no value to the test for selection since there proved to be no relation between success in the test and productive capacity. The relationship was worked out between success in the dexterity test at time of employment and the productive ability as measured by time-study standards. The Personian coefficient of correlation for a random selection of 300 cases gave the figure $r = .002$, showing that there was a purely chance relationship between the two.

Apparently the test measured a past or already acquired habit of quick dexterous movement rather than an ability to learn such movements. As a matter of fact, the learning of such movements was fairly rapid, so that even though an operative had not been dexterous previously he often could readily become so, and therefore the equipment of dexterity and of rapid movement which he brought with him was negligible in the long run.

The most common method of selecting operatives now in use in large plants is for the employment manager, a person of experience both in the judgment of people and in the requirements of the job, to form a personal estimate of the individual by means of an interview and to hire him or not as he sees fit. An improvement on this wholesale judgment is to make use of a definite rating scale by which different personal qualities are selected, and detailed ratings and credit given to each. This is a development of the officer's rating scale used in the army. It tends to standardize the interview and the resultant rating, and by insisting upon the judgment of specific qualities the interviewer is forced to take all the elements into consideration and to eliminate personal bias and snap judgments in so far as it is ever possible to eliminate them. If the rating scale were used, therefore, by employment managers of considerable experience in the industry concerned, as regards both the specific operations and familiarity with the type of applicant, it ought to be having as fair a trial as could be devised. Such was the case in the plant where this study was made. The two who collaborated in the rating of applicants were thoroughly acquainted by long actual experience both with the types of applicant and with the specific work which they were to do. A random selection was made of 247 operators who had gone through the course of training

and who had worked three or more months at their regular positions. The standardized rating scale had been filled out for all of the operatives, but they had been hired irrespective of the findings. After they had become productive workers and the rating scales were again consulted, the results showed, as measured by the coefficient of correlation, that there was no relationship between the personal rating and subsequent productive capacity in the shop. The outcome of this study, $r = 0.017$, seemed to show that the rating scale was of no value in predicting success at the machines—in fact it would have been as accurate if the predictions had been made by pure chance.

It might be suggested, however, that although a rating scale would be ineffective when used to predict a worker's efficiency, it might be valuable when designed to rate individual qualities such as pleasing personality, leadership, and aggressiveness. Since the difficulties of measuring these qualities or of agreeing on their value appeared insuperable the present study did not concern itself with this aspect of the problem.

Since every method so far had apparently failed to improve upon no method at all, it remained to attempt some other means of selection which would avoid the insufficiency of the interview and the rating scale and which would be more comprehensive than the dexterity test had proved itself to be.

The next step was therefore to try a mental examination. A test was worked out, modeled more or less upon the army tests. Neither the Alpha nor the Beta test was taken in its complete form for the reason that although every operative was required to speak and read English, and was able to do so, thereby making Beta not wholly necessary, yet the cultural and linguistic background among many applicants of foreign parentage was often so limited that Alpha was inadequate. Because of the high threshold of some tests in Alpha a modification of the two, upon experiment, seemed to suit our needs the best. It was composed of six different parts; recognition of geometrical objects, missing parts test, cancellation, a code test, cube estimation, and numerical sequence test. There was nothing original in the tests or in their combination. They had, however, the merit of being short and convenient, and they could be given to a group. Out of several hundred who took the test, 290 cases were taken at random and were investigated to find out whether ability as shown in the test had any relation to productivity at the machines. This productivity was measured with reference to the standard as set by time study and computed in per cents. Four weeks was taken as a productive period and an average made of the operative's work per

hour for the whole period. For example: If the standard set for a particular operation had been sixty units an hour and for the past four weeks an operator had averaged forty-five pieces per hour, the capacity would have been rated 75 per cent. Had the average been seventy-five pieces, it would have been rated at 125 per cent. The cases selected had passed through the learning period and were working at what was assumed to be their normal rate. It was, we thought, a fair sample of the operator's work.

As is apparent from observing the correlation table, there is a distinct tendency of association between mental grades and productivity at the machines. The coefficient was $-r=.51$ with a probable error of 0.029. It was possible with the test to make 66 points, and the question remained as to what amount of success was necessary to make an applicant worth training in the school as a machine operator? As can be seen from the table, the higher the standard required on the test, the greater number of average operators will be lost at the same time that the lower ones are eliminated. It was decided that the minimum requirement for passing should be 35 points. If, then, we had selected a fair sample, and the standard were set at 35, 48 operators who made below the average of the shop would be eliminated to every 7 who might be expected to make somewhat above the average—surely a great saving in expense of training. It is also a saving for the operator who is under capacity and who by continually failing to reach standard becomes discouraged and dissatisfied. We should have lost but one really good machine operator by this elimination process.

The management feels that it is its duty to take even many of those who failed to reach 35 points. But these operatives are placed in positions which do not require the same intelligence and alertness that are required on the regular operations. Incidentally, it is apparent that this group of workers, without qualifications as to their ability, were making on the average 92 per cent of the standards set for the piece workers. This would seem to show that the standards had been fairly set; and wherever this standard is set, such a gage is a definite and comparable method of measurement and is far more reliable and accurate than personal judgment or any other means of rating productive capacity when applied to machine operations.

In conclusion it should be said that although the mental test showed a fairly high relationship with the operator's performance at a machine, it was by no means complete or constant. There are undoubtedly a large number of factors that enter into the making of a skilled operator and insuring from that operator a steady flow of production. The

CORRELATION TABLE SHOWING THE RELATION OF SUCCESS IN PRODUCTION TO SUCCESS IN MENTAL TEST

PERCENT OF STANDARD REACHED

POINTS ON MENTAL TEST	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100-	105-	110-	115-	120-	125-	130-	135-	140-	145-	150-	155-	160-	165-	
60-64																1	1		1		1				4
55-59							1		2		4	3	1	3				1						1	17
50-54			1	2	3		3	4	5	3	5	3	2	2		2	2		1	2	2		1	3	46
45-49	1	2	4	3	5	6	6	6	4	5	7	4	2	2	3		1			1	1		1		58
40-44	1	4	4	11	5	3	4	7	5	5	5	3	1		1	1			1		1				58
35-39	2	2	4	4	2	4	3	8	9	1	6	1	2	1											49
30-34	1	2	2	3	4	1	6	6	1		4	1	1				1								33
25-29	1	2	1	4		1	2	1	1	1															14
20-24		2		2	1	1	1																		7
15-19			1			1																			2
10-14			2																						2
	4	10	16	22	23	21	25	29	29	15	31	15	9	8	4	4	6	1	4	2	5	1	2	4	0

MENTAL TEST - MEAN = 42.2

PERCENT OF STANDARD ATTAINED - MEAN = 92.2

r = 0.51

P.E. = .0293

above analysis tends to show that a definite minimum amount of intelligence or alertness is necessary. Beyond this the operator may still drag behind or fail, and one of the important causes, we are convinced, lies in the amount of incentive the operator brings to the work. To give an example, we have found that almost without exception if a girl is required by her parents to turn over her complete earnings she does not work nearly so well as when an agreement is made with her parents that she be permitted to have for herself all above a certain stipulated amount. The emotional background is equally important; but to try to describe all the ramifications of this factor and its attendant social and cultural aspects would be far outside this study.

In summary, therefore, we feel convinced of the following points regarding the employment methods in the Clothcraft Shops:

1. That estimates and predictions of an applicant's probable success as a factory operative, however standardized the rating scale may be, are of too slight a value to warrant depending upon it for selection of operators.

2. That an applicant's manual dexterity as measured by our test failed to be a criterion of ability to acquire skill at any particular machine.

3. That the use of mental tests, although only a partial measurement, is the quickest, most accurate and economical method of prophesying future skill at machines and of placing operators at types of work most suited to their capacity.

4. That a factory where payment is based upon standards which have been carefully established by time studies is peculiarly fitted to measure the value of industrial tests, since industrial success can be determined accurately by standardized productivity, and can be free from personal bias or varying definitions of what success may be.

THE USE OF THE MEDIAN IN DETERMINING SEASONAL VARIATION

By W. L. Crum

In determining the indexes of seasonal variation by the method of Professor Persons,[1] it is customary to take the median, of a series of link-relatives for a particular month, as the unadjusted index for that month. Although much has been written by Professor Persons in explanation of the use of the median in preference to some other average, a further study of the problem from a different point of view may serve to give additional confidence in the method used. It is the object of this paper to examine the form of the distribution of the series of link-relatives of a particular economic sequence, and to discuss in the light of this examination the relative advantages of the median and the mean.

The economic series selected is the Rate of Interest on 60–90 Day Commercial Paper, from January, 1890, to January, 1917. The link-relatives were taken directly from the *Harvard Review*,[2] and the deviation of each link-relative from the median belonging to that month was entered in Table I. The medians used were:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
90	94	105	99	98	98	108	109	108	102	98	103

They were taken from the *Harvard Review* where they had been calculated for the same period.[3] The series of deviations given in Table I is the basis of this study.

It may be said at once that we are begging the question in taking these deviations from the medians. This is, however, not the case. What we aim to study is the form of the distribution, and we shall find our chief interest centering in those items having wide deviations. Hence our conclusions would scarcely be altered if we chose the mean instead of the median as the zero value for a given month. In order to make the deviations in various months comparable with each other it was necessary to reckon them from zero points which varied from month to month. We chose the medians in order to obtain the

[1] *Cf.*, Persons, W. M., *Rev. of Econ. Statis.*, Prel. Vol. I, January, 1919.
[2] *Ibid.*, pp. 98, 99.
[3] *Ibid.*, p. 62.

TABLE I.

DEVIATIONS OF THE LINK-RELATIVES FROM THEIR RESPECTIVE MEDIANS
(Data for Rate of Interest on 60–90 Day Commercial Paper in N. Y.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1890.....		0	4	−6	1	1	−6	2	−6	1	41	−13
1.....	−11	−8	0	−2	7	5	−6	−7	−7	−5	−7	−8
2.....	−4	−6	2	−12	−6	−6	9	8	11	6	2	5
3.....	4	0	35	−14	18	34	3	−10	−22	−30	−23	−21
4.....	5	−1	−13	6	−6	1	−4	−6	−2	−19	5	0
5.....	14	28	2	3	−29	−2	4	11	6	17	−13	9
6.....	41	1	−14	4	−13	−4	13	42	1	0	−37	−32
7.....	0	−5	6	8	2	−9	1	0	2	0	−16	−2
8.....	7	−1	45	24	−18	−28	5	−9	6	−20	0	−11
9.....	4	8	23	−1	−1	−6	3	10	4	4	7	7
1900.....	−8	−2	5	−11	−12	2	0	−3	−3	12	−11	5
1.....	−4	−3	−4	7	1	2	0	−3	2	−8	4	1
2.....	3	−6	4	5	2	−1	3	−5	8	4	−1	2
3.....	−3	0	8	−5	−6	11	−3	0	−7	−5	5	−6
4.....	−6	4	−7	−11	−3	−6	−9	−11	4	1	−4	0
5.....	4	1	−2	3	1	−4	2	−8	5	2	14	2
6.....	−3	6	0	4	0	0	−4	1	1	−6	1	−3
7.....	8	3	−1	−3	−7	4	−3	0	1	3	6	5
8.....	−8	−17	6	−21	−8	−4	−6	−13	0	3	0	−8
9.....	6	2	−6	1	0	−3	−4	11	−3	16	3	−3
1910.....	3	0	−4	7	2	3	4	−8	−6	−1	1	−18
1.....	−5	9	−10	−5	1	4	−6	2	0	−6	−8	15
2.....	−6	2	7	0	3	−3	5	1	3	5	−1	2
3.....	−8	6	12	−3	−1	12	−5	−10	−12	−4	0	−1
4.....	−9	−9	−4	−3	6	1	7	35	−2	−6	−13	−24
5.....	−2	4	−15	9	4	0	−19	0	−16	−3	−5	2
6.....	10	6	−5	1	2	18	0	−14	−17	−2	6	9
7.....	1											
Medians...	90	94	105	99	98	98	108	109	108	102	98	103

distribution of deviations applicable to the method actually used in practice.

From Table I we get the frequency distribution of the deviations, and the results are shown in Table II. In all the calculations in this study the class interval was a single per cent unit (the percentage

TABLE II

FREQUENCIES OF DEVIATIONS FROM THE MEDIANS

Deviation	Frequency	Deviation	Frequency	Deviation	Frequency
*Over −30	2	−11	6	6	13
−30	1	−10	3	7	8
−29	1	−9	5	8	6
−28	1	−8	11	9	5
−24	1	−7	6	10	2
−23	1	−6	23	11	4
−22	1	−5	10	12	3
−21	2	−4	13	13	1
−20	1	−3	19	14	2
−19	2	−2	9	15	1
−18	2	−1	11	16	1
−17	2	0	28	17	1
−16	2	1	22	18	2
−15	1	2	22	23	1
−14	3	3	13	24	1
−13	6	4	19	28	1
−12	3	5	13	†Over 30	7

*−32, −37.

†34, 35, 35, 41, 41, 42, 45.

involved is the ratio of the item of one month to the preceding); for although sufficiently reliable results could doubtless have been obtained with a coarser classification, the calculations were not so laborious as to prevent the fullest use of the actual data. From the frequency table are derived the first six moments of the distribution, and the results appear in Table III. The ν_i' are the moments about the arbitrary origin (taken as zero deviation), the ν_i are the moments about the arithmetic mean,[1] and the μ_i are the final values after the application of the Sheppard Adjustments.[2] At first glance, it may seem as if there is no occasion for using the adjustments in this problem. Nevertheless, although the series in Table II appears to consist solely of discrete numbers, the original percentages may range over a continuous scale. The values of ν_5 and μ_5 were not found because they were not needed in the subsequent calculations.

TABLE III

MOMENTS AND CHARACTERISTICS

N = 324

i	1	2	3	4	5	6
ν_i'	−.46	107.06	656.45	83520.	3015000.	110890000.
ν_i	0.00	106.85	793.68	84860.		119480000.
μ_i	0.00	106.77	793.68	84465.		119370000.

$$\sigma = \sqrt{\mu_2} = 10.33,\ \beta_3 = -\frac{1}{6}\frac{\mu_3}{\sqrt{\mu_2^3}} = -.12,\ \beta_4 = \frac{1}{24}\left(\frac{\mu_4}{\mu_2^2} - 3\right) = .142$$

$$S = 3\beta_3 = -.36,\ E = 3\beta_4 = .426$$

DISSECTION OF THE SERIES

$$\text{"Excess"} = \frac{\mu_4 - 3\mu_2^2}{3\mu_2^2} = \epsilon_1 > 0 \qquad \text{"Defect"} = \frac{\mu_2 - 5\mu_3\mu_4}{5\mu_2^2} = \epsilon_2 > 0$$

$$(\mu_4 - 3\mu_2^2)w^2 + \left(\mu_3\mu_4 - \frac{\mu_5}{5}\right)w - \left(\frac{\mu_2^3}{3} - \frac{\mu_3\mu_5}{5}\right) = 0$$

$$w_1 = 141.71 \qquad w_2 = 6.068$$

$$C_1/N = \frac{\mu_2 - w_2}{w_1 - w_2} = .74 \qquad C_2/N = \frac{w_1 - \mu_2}{w_1 - w_2} = .26$$

$$\sigma_1 = \sqrt{w_1} = 11.9 \qquad \sigma_2 = \sqrt{w_2} = 2.46$$

$$\sigma_1/\sigma_2 = 4.8$$

Appended to Table III are the several coefficients and characteristics to be used in this discussion, together with the formulas for calculating them from the moments. Probable errors of these constants are not given; but as most of the probable error formulas contain $\sqrt{N} = 18$ in the denominator, we need not expect large values of the errors.

The displacement, b, of the mean from the assumed origin is small; and this indicates that there is no wide difference between the mean

[1] Pearson, K., *Phil. Trans. Roy. Soc. London*, 185 (1894) A, p. 77.

[2] Sheppard, W. F., *Proc. London Math. Soc.*, 1897, p. 353 *et seq.*

and the median. The value of the standard deviation, σ, is just over 10; and we note at once that 9 items of the series have deviations greater than 3σ. If the series were truly normal, so large a number of high deviations would not occur in a group of 324.

The constants S and E are the skewness and excess, two of the "characteristics" of the Charlier[1] Type A curve which was fitted to the

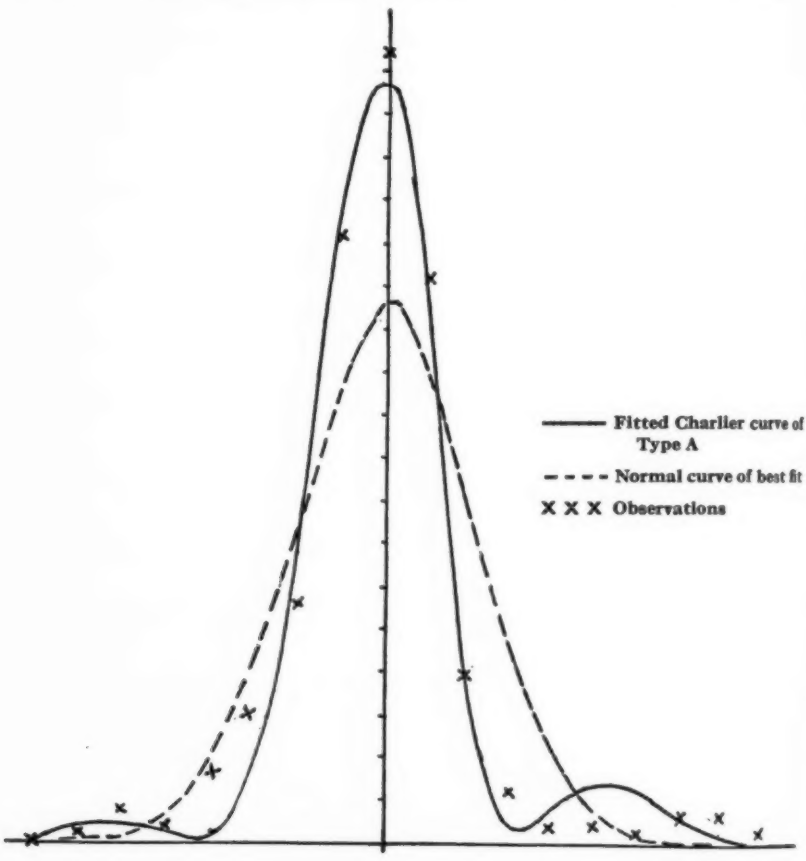


FIGURE 1. COMPARISON OF CHARLIER AND NORMAL CURVES

series. The negative value of S indicates that the curve is skewed slightly to the left—that the mode lies to the left of the mean. The positive E signifies an elevation of the mode above the position it would have in a normal distribution. The Charlier curve, and the normal curve of best fit, are shown in Figure I. Because of the

[1] Charlier, C. V. L., *Vorlesungen über die Grundzuge der mathematischen Statistik*, Lund, 1920, p. 67.

irregularities in the original series the frequencies were grouped in class intervals of five units for the comparisons with the theoretical curves. The close correspondence of the observed series to the Charlier curve appears from the figure, and further comparison with the Charlier curve and the normal curve can be made by use of Table IV. The chief feature of the curve is the close grouping of the bulk of the items about the mean, accompanied by a considerable frequency at some distance on either side of the mean. The points corresponding to the inflexions of the normal curve are very low in the actual curve.

TABLE IV

COMPARISON OF THE THEORETICAL AND ACTUAL DISTRIBUTIONS

Approximate deviations	Charlier type A	Frequencies grouped observations	Sum of component normals	Normal curve of best fit
−40	.08	0	0	0
−35		.2		
−30	.43	.8	.3	.14
−25	.37	.4	.8	.55
−20	.08	1.6	1.8	1.66
−15	1.47	2.8	3.6	4.10
−10	7.28	5.65	5.7	7.55
− 5			9.0	
− 2	15.3	14.2	15.8	10.6
0			21.7	
2	17.8	18.4	15.8	12.7
5	11.7	13.2	9.0	10.6
10	3.60	4.0	5.7	7.55
15	.38	1.2	3.6	4.10
20	.90	.4	1.8	1.66
25	1.44	.4	.8	.55
30	1.03	.2	.3	.14
35		.6		
40	.13	.6	0.0	0.0
45		.2		

Owing perhaps chiefly to the effect of the skewness factor, even the Charlier curve does not fit very well in the region farthest from the mean. The appearance of the distribution led to an attempt to "dissect" it, after the method of Pearson,[1] into two normal curves. Ignoring the actual skewness, we shall assume that the two component normal curves have their means coincident with the general mean of the series. Since the Pearsonian "Excess" and "Defect" do not have opposite signs, a solution is possible; and the computations are shown in Table III. We summarize here the essential facts about the two component normal curves:

$$C_1/N = .74 \qquad C_2/N = .26$$
$$\sigma_1 = 11.9 \qquad \sigma_2 = 2.46$$

[1] Pearson, K., On the dissection of asymmetrical frequency curves. *Phil. Trans. Roy. Soc. Lond.*, 185 (1894) A.

where C_i/N is the per cent of the total frequency belonging to the component curve i. The resulting compound curve is shown in Figure 2, with the grouped original observations plotted for comparison;

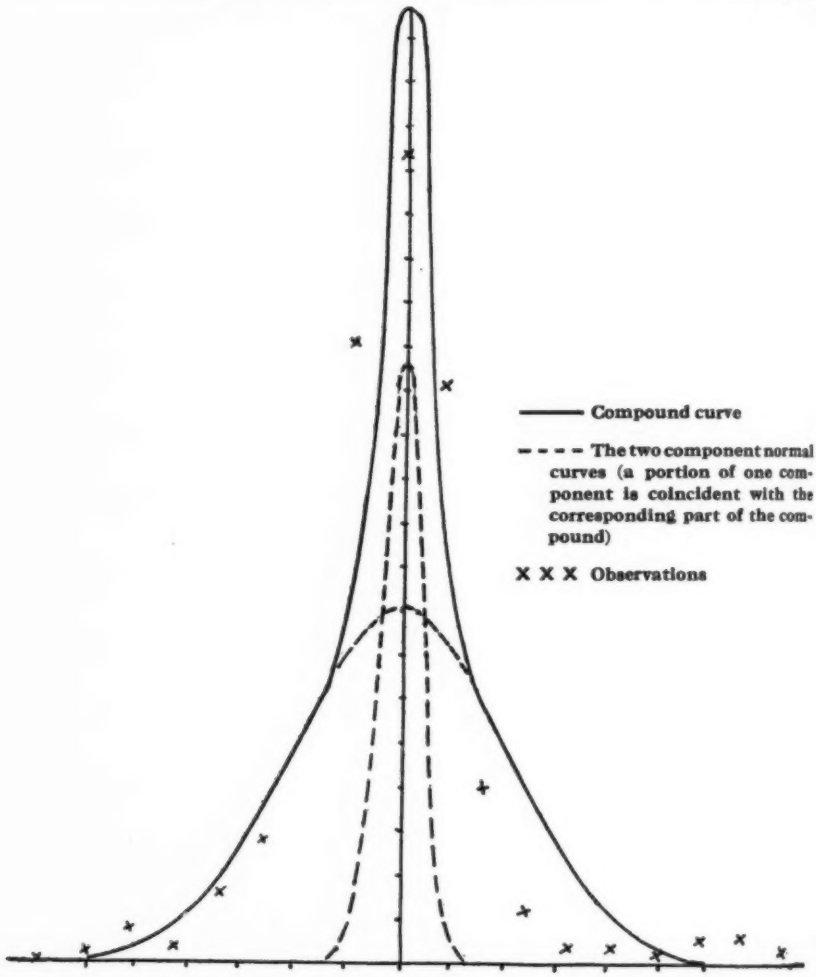

Compound curve
The two component normal curves (a portion of one component is coincident with the corresponding part of the compound)
X X X Observations

FIGURE 2. COMPARISON OF ACTUAL DISTRIBUTION WITH COMPOUND CURVE

numerical comparison may be made from Table IV. The fit is fairly good, and undoubtedly better than that of the single normal curve.

Yule[1] has shown that if a distribution may be dissected into two normal distributions each of half the original frequency, and if the ratio between the two standard deviations exceeds 2.24, the median

[1] Yule, G. U., *An Introduction to the Theory of Statistics*. London: Griffen. 1919. Pp. 339–40.

has a smaller probable error than the mean. The actual modification of his analysis to cover values of C_i/N different from $\frac{1}{2}$ is not readily accomplished. In fact, for a division of the total frequency into non-equal portions, his equation for determining the ratio takes the form:

$$a^2b\rho^4+2ab^2\rho^3+\left(a^3+b^3-\frac{\Pi}{2}\right)\rho^2+2a^2b\rho+ab^2=0$$

where a is C_1/N and b is C_2/N, and ρ is the ratio of σ_1 to σ_2. Now, this equation cannot be solved for the general case with the same facility as the symmetrical equation which he used. For the case in hand we can, however, get a solution to a high degree of approximation; for here we have almost exactly $\frac{3}{4}$ for a and $\frac{1}{4}$ for b. The quartic is then approximately:

$$\rho^4+6\rho^3-24\rho^2+2\rho+3=0$$

and a solution lies between 2.5 and 2.6. Actually, the ratio in the present case is much larger, for $\sigma_1/\sigma_2=4.8$, and we may therefore

TABLE V

MONTHLY FREQUENCIES OF THE DEVIATIONS

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Deviation
	b		d	e	f	g		k	m	n	p	Extreme negatives
		1										−15
		1	1				1					−14
		1		1			1			2	1	−13
			1	1				1				−12
1		2					1			1	1	−11
		1					2					−10
1	1				1	1	1					−9
3	1			1			2		1	1	2	−8
		1		1			1	2		1		−7
2	2	1	1	3	3	4	1	1	3		1	−6
1	1	1	2			1	1		2	1		−5
2		3			3	3			2	1		−4
2	1		3	1	2	3	2	2	1		2	−3
1	2	1	1		1			2	1		1	−2
	2	1	1	2	1				1	2	1	−1
1	4	2	1	2	2	3	4	2	2	3	2	0
1	2		2	4	3	1	2	3	2	2	1	1
	1	2		4	2	1	2	2	1	1	4	2
2	1		2	1	1	2		1	2	1		3
3	2	2	2	1	2	2		2	1	1		4
1		1	1		1	2		1	1	2	3	5
1	3	2	1	1				2	1	2		6
1		1	2	1		1				1	1	7
1	1	1	1				1	1				8
	1		1			1					2	9
1							1					10
					1		2	1				11
		1			1				1			12
1						1						13
										1		14
											1	15
a	b	c	d	e	f		h		m	n		Positives extreme

Extreme items: a, 41; b, −17, 28; c, 23, 35, 45; d, −21, 24; e, −18, −29, 18; f, −28, 18, 34; g, −19; h, 35, 42; k, −16, −17, −22; m, −19, −20, −30, 16, 17; n, −16, −23, −37, 41; p. −18, −21, −24, −32.

conclude that the median is more stable than the mean for this series.

It will be apparent that the above conclusion pertains to the median of the whole series rather than to the several medians of the individual months. In order to use the methods of curve fitting without too great probable errors it was necessary to have a long series. Having determined the nature of the series as a whole, we may extend our conclusions to the series for each month. These twelve separate series are shown in Table V. It is clear that they are even more noticeably affected by those irregular and wide deviations which were found in the entire series. We feel justified therefore in believing that our conclusions are more clearly applicable to the individual months than to the series as a whole. The large number of extreme variations renders the mean an unreliable average, and the median is a better index of seasonal variation.

We should, however, make one reservation. Owing to the small number of items in the series for any one month, it is possible that the median may be isolated in the middle of the series and that a denser series might have brought the median a unit above or below its present position. Such instances occur for July and August in Table V. In order to avoid this danger it is suggested that we take, instead of the simple median, the mean of a middle group of items (two or four if the series contains an even number of items, three if an odd number) as the value of the unadjusted index. This plan will remove the lack of precision inherent in the simple median of a small number of items and still retain the advantage of the median in its independence of the large items.

Finally, it should be remarked that the above discussion has to do with a particular economic sequence and does not in itself show that the median is a better index for all series. Nevertheless, the characteristic features of the distribution we have examined—close grouping of the majority of the items attended by wide dispersion of the remaining items—are found generally in historical economic series; and we may be confident that our findings can be extended to all problems of seasonal variation in economic factors.

CANADIAN EMPLOYMENT STATISTICS

By Ralph G. Hurlin, *Russell Sage Foundation*

The Employment Service of Canada was established in 1918, as a reconstruction measure, to coördinate and expand the public employment services of the several provinces, and to supplant private enterprise in this field. The Service has experienced great success as an employment agency and has acquired practically a monoply of the employment office business in Canada. In addition to the administration of labor placement offices and clearing houses, the bureau was specifically charged with the study and report of unemployment conditions and with the collection and publication of information concerning the state of the labor market. In the discharge of the latter duty an efficient statistical service was developed, which has provided Canada with the most complete and informing statistical record of employment changes, covering the past three years of aggravated economic disturbance, which is available in any country. This record is worth examination both because of its historical value and because its compilation has contributed to the technique of employment statistics.

Maintenance of three independent series of employment statistics, each of which has furnished a significant index of employment fluctuation, was begun by the Employment Service early in the year 1919. They are: statistics of vacancies, applications and placements of employment offices; statistics of unemployment among trade union members; and statistics of employment obtained from employers of labor. Of these, the most significant for purposes of general information concerning employment conditions is the last. This was an entirely new series for Canada, while each of the other two had been maintained previously by the Department of Labour.

THE COLLECTION OF EMPLOYERS' RETURNS

The plan adopted for the collection of employers' returns was based in part upon the experience of the United States Bureau of Labor Statistics and the New York Department of Labor, both of which bureaus have collected similar data in the United States since 1915. The Canadian statistics, however, were made more representative than those of either of these bureaus. While the United States figures applied only to manufacturing industries and to selected establishments, the Canadian bureau undertook to include all industries except agricul-

ture and all employers employing more than ten persons. The latter condition assured much more than was necessary for adequate sampling, and is explained by the fact that the information was desired at the outset not only to afford an index of the trend of employment, as was the case with the United States figures, but also for the purpose of informing the local employment offices of the Service of changes in the labor market in their vicinity.

The collection of the data was made through four district clearing offices of the Service. Questionnaires calling for the number of persons on the last payroll, the number anticipated on the next payroll, and a statement of prospective additions and reductions, by occupations, were returned by the employers to the district offices. The local employment offices were informed of actual and prospective additions and reductions reported by establishments in their territories, and summary reports were forwarded to the central office of the Service for the purpose of the statistical record. The attempt to utilize the employers' returns to notify the local offices of existing vacancies and available labor supply was discontinued after some trial, and the statistics have since been maintained only for statistical purposes. The questions concerning prospective employment were therefore omitted from the questionnaire and less attention was given to securing returns from the smaller employers. The statistics have continued to be unusually comprehensive, however. In late 1922, reports were being received from between six and seven thousand employers with an aggregate employment of nearly 800,000 persons.

At the time these statistics were inaugurated, demobilization presented a pressing employment problem, and as an aid in finding jobs for the returning army the employers' returns were required weekly. Later, semi-monthly, and since May, 1922, only monthly, returns have been obtained. In Diagram 1, below, all the available figures have been plotted, and it may be observed that the more frequent data do not furnish an appreciably more accurate indication of the employment trend than the monthly figures. On the other hand, the reduction in the number of reports adds materially to the convenience of the employers concerned.

Certain precautions which were taken prior to any attempt to collect the data, and which explain in part the success which was had from the first in securing reports from a large number of employers, are worth recording. Special effort was made to cause as little inconvenience to the employers as possible. The questionnaire was made brief, and assurance was given that facts concerning individual establishments would not be revealed. An agreement also was reached

with other official bureaus, both federal and provincial, that no other attempts to collect information on this subject would be made. The further precaution was taken to provide, in support of the authority to collect the data, a penalty for non-compliance on the part of employers. This penalty was made applicable to any employer who, without reasonable excuse, should refuse or neglect to answer, or who should answer falsely, the questions put to him on the employment questionnaire. In fact, the penalty has not been imposed up to the present time, but it is said to have been, nevertheless, of assistance in establishing contacts with employers who were loath to furnish the desired information. With the support of such a penalty, a collecting bureau still has need of great consideration in dealing with reporting establishments, but it is spared much of the uncertainty that accompanies coöperation that is to any extent voluntary on the part of employers.

EMPLOYMENT TRENDS IN EIGHT DIVISIONS OF INDUSTRY

Index numbers based on the employers' returns have been published for eight major groups of industry and for the more important subdivisions of these groups since January, 1920.[1] The curves for the eight main divisions are shown in Diagram 1 for three full years to the end of 1922. The variation in the index numbers is to be measured from 100 per cent, and since the scale in each section of the diagram is the same, direct comparison may be made between the curves for each group. The original index numbers are computed in terms of January, 1920, but for the present purpose they have been converted to make the average of the numbers for the year 1920 equal 100, so that the curves are to be read as showing variation from the average employment during that year.

As might be expected, the most important influence of the business cycle is shown in the case of manufactures. Employment in manufacturing industries in Canada suffered its major reduction in the latter part of 1920, but underwent another substantial decline at the end of the following year; improvement began only in 1922. Mining reveals relatively slight influence of the business depression, but the typical seasonal fluctuation of the coal industry is shown. Both communication and transportation, the latter including water, rail,

[1] These figures have been published from month to month in the *Labour Gazette*, the official publication of the Department of Labour, together with other employment statistics. Beginning in July, 1921, a special bi-monthly, and later monthly, bulletin, *Employment*, was published by the Employment Service, which contained all official employment statistics. This was discontinued in November, 1922, following reorganization of the Service, and at this time the statistics obtained from employers' returns were transferred from the Employment Service in the Department of Labour to the Dominion Bureau of Statistics, to be compiled there "for the use of the Department of Labour."

and road transportation, show conspicuous seasonal fluctuation, and in the case of communication the influence of depression is shown in 1921 and 1922. In the case of trade, declines are registered which correspond closely in time with those in manufacturing, which is to be expected to the extent that trade is dependent upon the income of the

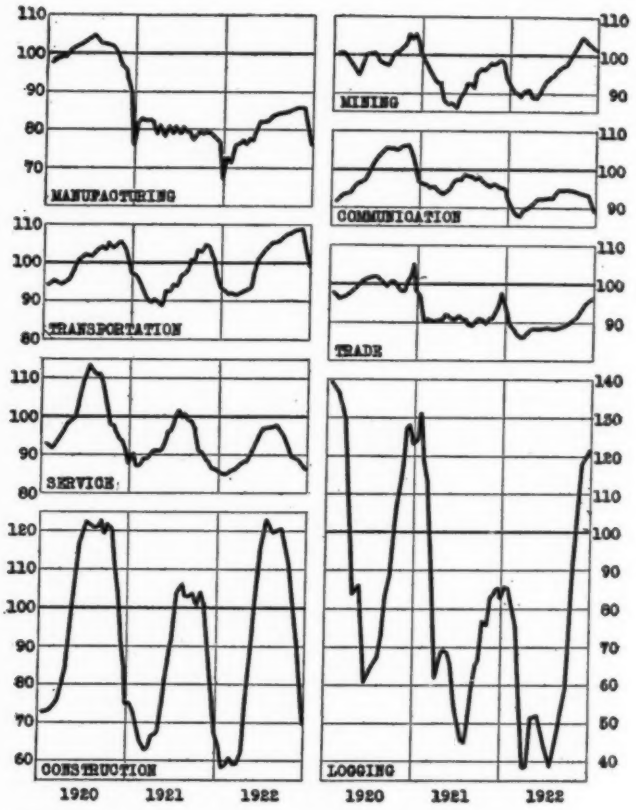


DIAGRAM 1. INDEXES OF EMPLOYMENT IN EIGHT PRIMARY DIVISIONS OF INDUSTRY IN CANADA, 1920–22

large proportion of wage-earners in manufacturing industries. This curve records interestingly the regular pre-Christmas expansion in trade. The curve labelled "Service" represents chiefly employment in laundries and hotels, although some professional service is also included. It shows in addition to a wide seasonal fluctuation noticeable decline in 1921 and 1922 as compared with 1920. In logging and construction employment undergoes exaggerated seasonal variation. For logging, the Canadian figures show at the winter peak of employ-

ment a volume more than twice as great as in summer. Depression in this industry continued into the summer of 1922, but there has been substantial improvement in the present winter. In the case of construction, which includes railroad and highway as well as building construction, there was depression in 1921, but the summer level of 1922 was approximately equal to that of 1920. These two groups of industries undergo alternating seasonal fluctuation, and there is said to be some interchange of labor between railroad construction and logging. In the main, however, the winter employment in logging camps is recruited from sawmills, here classified with manufactures, which also alternate with logging in a wide seasonal activity.

The several curves in this diagram represent by no means equal groups of labor. The percentage of the total represented by each varies with seasonal fluctuation but on the average is approximately as follows: manufacturing 56, transportation 15, construction 8, trade 8, mining 6, communication 3, logging 2, service 2. The manufacturing group outweighs all the others and as a result controls the index number for all the industries combined, as may be seen in Diagram 3. It also, as has been observed in the case of trade, determines to some extent the variation in certain of the other groups.

Because figures are not available for the purpose in other countries, it is of interest to compare more definitely than can be done in the diagram the effect of the cyclical depression in these primary divisions of industry. This can be done roughly by comparing the annual index numbers, in which the varying effect of seasonal fluctuation is eliminated. These numbers are shown in the following tabulation in order of the amount of decline.

ANNUAL INDEX NUMBERS FOR EIGHT INDUSTRY GROUPS

	1920	1921	1922
Transportation	100	96	101
Mining	100	94	96
Communication	100	96	92
Service	100	93	91
Trade	100	92	90
Construction	100	85	90
Manufacturing	100	80	81
Logging	100	77	69

COMPARISON OF INDEXES FOR NEW YORK AND CANADA

Diagram 2 compares the curve for manufactures in Canada with the similar curve of the New York Department of Labor, which has been shown to be fairly representative of manufacturing industries

for the United States as a whole. It is presented to demonstrate the similar effect of the cycle on either side of the international boundary. In both cases 100 per cent equals the average of the numbers for the year 1920. Since the New York index is based on monthly figures throughout, only a single figure in each month was used in plotting the curve for Canada, the mid-monthly figure being used where more than one was available to agree with the New York curve. Except that the temporary declines at the end of December, apparently due

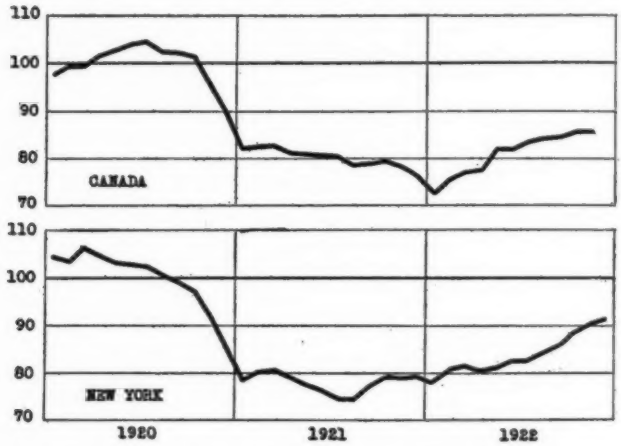


DIAGRAM 2. INDEXES OF EMPLOYMENT FLUCTUATION IN MANUFACTURING INDUSTRIES IN CANADA AND NEW YORK, 1920–22

to inventory periods, are not revealed, this curve corresponds closely with that for manufactures in Diagram 1.[1]

Almost the same amount of reduction in employment is recorded by these curves, and there is similarity in the extent of recovery indicated in 1922. Difference will be noted in the timing of the decline and the subsequent recovery, but the length of the interval between the turn down and turn up is approximately the same in each case. Apparently the difference in the timing of the cycle is to be accounted for in the different composition of the two manufacturing groups. In Canada important seasonal industries with pronounced peaks of activity in the late summer contribute to delay the beginning of the decline in 1920 and to postpone decline in 1921 until the end of the year. Comparison of identical subdivisions of the two manufacturing groups reveals even more striking similarity.

[1] At present the monthly figures for Canada refer to conditions at the end of each month, with the unfortunate result that the December figure records the temporary inventory drop. Because it cannot be considered typical for the month, this December figure is not plotted in Diagram 2.

THREE TYPES OF EMPLOYMENT INDEX

A third diagram is presented for the purpose of comparing the three varieties of employment index which are afforded by the Canadian statistics. The first is that derived from the employers' returns already described. As has been indicated, it represents the important industries with the exception of agriculture. While some are more completely represented than others, this index may be presumed to

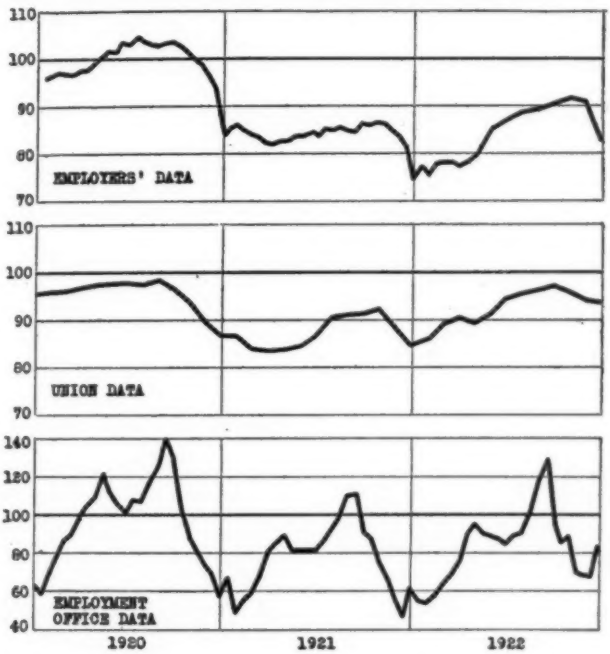


DIAGRAM 3. GENERAL INDEXES OF EMPLOYMENT FLUCTUATION DERIVED FROM THREE TYPES OF STATISTICS MAINTAINED BY THE EMPLOYMENT SERVICE OF CANADA, 1920–22

record accurately the general employment changes for these industries as a group.

The second index is derived from monthly reports of unemployment in trade unions. In some months these reports have represented as high as 90 per cent of the entire trade union membership in Canada and they regularly include from 70 to 80 per cent of the total membership. From them is computed the per cent of union membership unemployed on account of lack of work, and this figure is inverted for the purpose of the index number. This curve is to be read, therefore, as showing per cent of union membership employed. This

index, like that from employers' data, fails to include agriculture. The other important industries are represented, though in quite different proportions in this case. For example, transportation has here a weight of approximately 37 per cent, manufactures only 30, and construction 16. Notwithstanding this, the two curves show remarkable correspondence. It should be noted concerning the index for union labor that since it is computed as a per cent of membership it can never pass 100 per cent. In case of unusual expansion of employment it must fail to record the fact beyond a certain point, whether or not union membership expands with employment. Thus in 1920 when employment was at its highest level this index number remains below 100, and not much above the level reached in the fall of 1922.

The third curve in the diagram shows the number of vacancies recorded per 100 applicants registered at all employment offices of the Service. This ratio is not computed by the Service but is obtained from the published figures. It is a convenient and, where the underlying figures are comprehensive, a significant measure of the relation between demand for and supply of accessory labor. This index includes agriculture as well as the industries represented by the other two. This, even more than the fact that seasonal industries are naturally over-represented in employment office statistics, accounts for the extensive seasonal variation in this curve. In the harvest season, in some months, more than half of the placements of the Canadian employment offices have been in agriculture and, in spite of the fact that applications regularly increase in response to this demand, this is the largest factor in the summer excess of jobs. The cyclical influence is clearly to be seen in this case, however, in the lower level of the curve in 1921. In this year jobs exceeded applicants for a period of only one month as compared with seven in 1920 and two in 1922.

For the purpose of a general index of employment the employment office data are clearly of less value than those affording the other indexes, but it is not improbable that for agriculture and certain other less well-organized industries, statistics of a country-wide system of employment offices, such as that in Canada, might yield the most reliable indication of employment changes that can be had.

NOTES

A COMBINATION FORM FOR CALCULATING THE CORRELATION COEFFICIENT AND RATIOS

By Karl J. Holzinger, *University of Chicago*

The increasing use of the coefficient of correlation has led a number of workers in statistics to devise short methods and to work out set forms for performing the calculations. The aims of these devices have been to shorten the labor of calculation and to systematize the procedure in such a way as to reduce arithmetical errors to a minimum. The principle underlying these short methods is that it is easier to perform the calculations on integers rather than on decimals of several places. With slight modification the methods described by Harris, Thompson, Thurstone, Ayres,[1] and others are all equivalent, the moments being taken from arbitrary origins with subsequent adjustment. For the purpose of systematizing the arithmetical procedure, a number of forms or charts have been devised. These consist of a blank correlation table, with formulas on the margins of the sheet. The writer is familiar with those designed by Kelley, Thurstone, and Toops for calculating the coefficient of correlation. Any one who has used such forms realizes the enormous saving of time when "batteries" of coefficients are to be computed.

The form described below represents an attempt not only to combine the best short methods with systematic procedure, but also to furnish a simple device for calculating the coefficient of correlation and the two correlation ratios on a single sheet. In using the form, the correlation coefficient may be computed first, and then if the table suggests non-linear regression, the correlation ratios may be readily found. The notation employed, although apparently clumsy, has been chosen because it is more suggestive of the arithmetical operations involved, and it has been found to be clearer to non-mathematical students than the abbreviated biometric form.

The proofs of the "short" formulas so clearly described by Dr. Ayres may be given in the following notation:

X, Y ..... variables from arbitrary origins
$\bar{x}, \bar{y}$ ..... arithmetic means for whole table
x, y ..... variables from respective means as origins

[1] L. P. Ayres, "A Shorter Method for Computing Coefficients of Correlation and of Regression and the Correlation Ratio." *Journal of Educational Research*, March, April, May, and June, 1920.

$\bar{y}_x, \bar{x}_y$ ..... means of columns and rows respectively
Fx, Fy ..... frequencies of columns and rows
Fxy ..... frequency of a cell common to a column and row
N ..... frequency of table
Σ ..... summation over whole table
Σ' ..... summation over a column or row
A ..... assumed mean

$$r_{xy}=\frac{\Sigma xy}{N\sigma_x\sigma_y}=\frac{\Sigma xy}{\sqrt{\Sigma x^2\Sigma y^2}}$$

Substituting $x=X-\bar{x}$, $y=Y-\bar{y}$ in this last expression gives

$$r_{xy}=\frac{\Sigma XY-\dfrac{(\Sigma X)(\Sigma Y)}{N}}{\sqrt{\left[\Sigma X^2-\dfrac{(\Sigma X)^2}{N}\right]\left[\Sigma Y^2-\dfrac{(\Sigma Y)^2}{N}\right]}}$$

or, expressed in terms of the symbols of operation

$$(1)\qquad r_{xy}=\frac{\Sigma F_{xy}XY-\dfrac{(\Sigma F_xX)(\Sigma F_yY)}{N}}{\sqrt{\left[\Sigma F_xX^2-\dfrac{(\Sigma F_xX)^2}{N}\right]\left[\Sigma F_yY^2-\dfrac{(\Sigma F_yY)^2}{N}\right]}}=\frac{a}{\sqrt{bc}}\ \text{(Say)}.$$

Pearson's correlation ratio may be written in the form,

$$\eta_{yx}=\frac{\sqrt{\dfrac{\Sigma F_x(\bar{y}_x-\bar{y})^2}{N}}}{\sigma_y}=\sqrt{\frac{\Sigma F_x(\bar{y}_x-\bar{y})^2}{c}},\ \text{since}\ \sqrt{c}=\sigma_y\sqrt{N}.$$

$$\bar{y}_x=A+\frac{\Sigma' F_{xy}Y}{F_x}$$

$$\bar{y}=A+\frac{\Sigma F_yY}{N}$$

$$\bar{y}_x-y=\frac{\Sigma' F_{xy}Y}{F_x}-\frac{\Sigma F_yY}{N}$$

$$(\bar{y}_x-\bar{y})^2=\frac{(\Sigma' F_{xy}Y)^2}{F^2{}_x}-2\left(\frac{\Sigma F_yY}{N}\right)\left(\frac{\Sigma' F_{xy}Y}{F_x}\right)+\frac{(\Sigma F_yY)^2}{N^2}$$

$$F_x(\bar{y}_x-\bar{y})^2=\frac{(\Sigma' F_{xy}Y)^2}{F_x}-2\left(\frac{\Sigma F_yY}{N}\right)(\Sigma' F_{xy}Y)+\frac{F_x(\Sigma F_yY)^2}{N^2}$$

$$\Sigma F_x(\bar{y}_x-\bar{y})^2=\Sigma\left[\frac{(\Sigma' F_{xy}Y)^2}{F_x}\right]-2\left(\frac{\Sigma F_yY}{N}\right)(\Sigma F_yY)+\frac{(\Sigma F_yY)^2}{N}$$

$$\Sigma F_x(\bar{y}_x-\bar{y})^2=\Sigma\left[\frac{(\Sigma' F_{xy}Y)^2}{F_x}\right]-\frac{(\Sigma F_yY)^2}{N}.$$

Therefore,

$$(2) \qquad \eta_{yx} = \sqrt{\frac{\Sigma\left[\frac{(\Sigma' F_{xy} Y_1)^2}{F_x}\right] - \frac{(\Sigma F_y Y)^2}{N}}{\Sigma F_y Y^2 - \frac{(\Sigma F_y Y)^2}{N}}} = \sqrt{\frac{e}{c}} \quad \text{(Say)}.$$

Similarly,

$$(3) \qquad \eta_{xy} = \sqrt{\frac{\Sigma\left[\frac{(\Sigma' F_{xy} X)^2}{F_y}\right] - \frac{(\Sigma F_x X)^2}{N}}{\Sigma F_x X^2 - \frac{(\Sigma F_x X)^2}{N}}} = \sqrt{\frac{d}{b}} \quad \text{(Say)}.$$

It will also be noted that the two regression coefficients b_{yx} and b_{xy} are given by the expressions $\frac{a}{b}$ and $\frac{a}{c}$ respectively.

In using the form the steps are briefly as follows:

1. Tabulate the frequencies in the cells. Obtain the marginal frequencies F_x and F_y, and the total frequency N.

2. Choose the origins near the centers of the distributions and tabulate the variables X and Y in classes from these origins, 1, 2, 3, etc., -1, -2, -3, etc.

3. Multiply each frequency F_y by the corresponding Y, giving the quantities in the column headed $F_y Y$. The total of this column is $\Sigma F_y Y$. (Similarly for the X distribution.)

4. Multiply each item in the column headed $F_y Y$ by the corresponding Y, giving the quantities in the column headed $F_y Y^2$. Check by squaring the values of Y and multiplying by the corresponding frequencies F_y. The total of the column is $\Sigma F_y Y^2$. (Similarly for the X distribution.)

5. Square the quantity $(\Sigma F_y Y)$, divide by N and subtract the result from $\Sigma F_y Y^2$, giving c. (Similarly for the X distribution, giving b.)

6. Multiply each cell frequency, F_{xy}, by the corresponding Y, marking these values in the corners of the proper cells.

7. Add each column of values thus obtained, giving the sums $\Sigma' F_{xy} Y$.

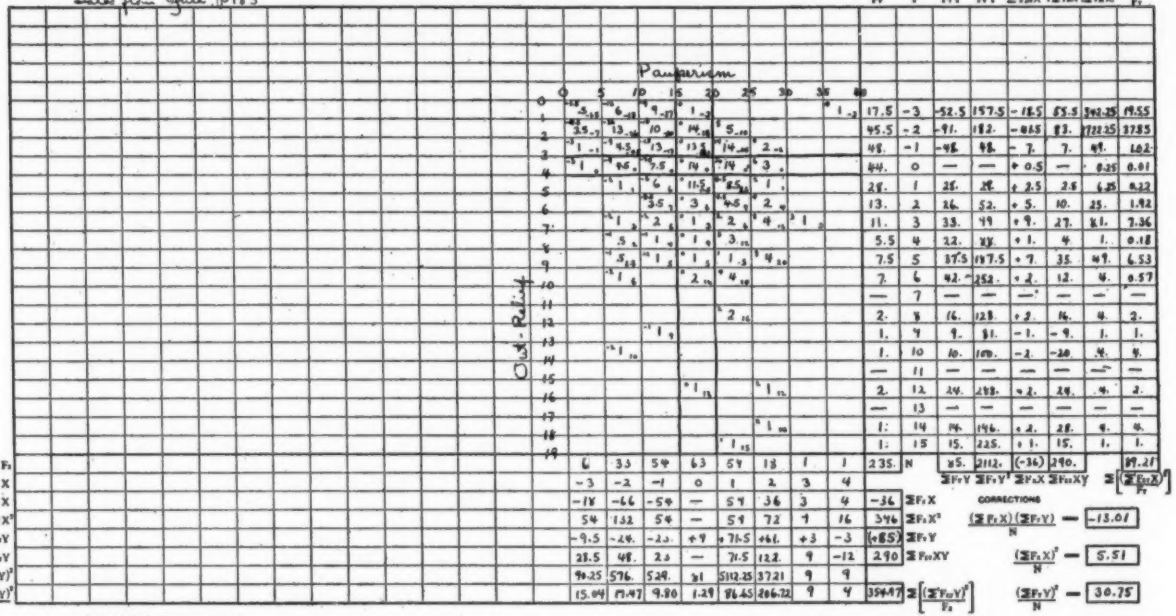
8. Multiply each of these sums by the corresponding X, giving the products $X\Sigma' F_{xy} Y$. The sum of such products is $\Sigma F_{xy} XY$. (Similarly $\Sigma(Y\Sigma' F_{xy} X) = \Sigma F_{xy} XY$.)

9. Multiply $(\Sigma F_x X)$ by $(\Sigma F_y Y)$, divide by N and subtract (algebraically) the result from $\Sigma F_{xy} XY$, giving a.

10. The remainder of the calculation for r_{xy} is outlined on the sheet

FORM FOR CORRELATION COEFFICIENT AND RATIOS

Data from Yule, p183



F_Y	6	33	54	63	54	18	7	1	235.	N	85.	2112.	(-36)	290.				89.21
X	-3	-2	-1	0	1	2	3	4			$\Sigma F_Y Y$	$\Sigma F_Y Y^2$	$\Sigma F_{YX} X$	$\Sigma F_{YX} XY$				$\Sigma\left[\frac{(\Sigma F_{YX} X)^2}{F_Y}\right]$
$F_X X$	-18	-66	-54	—	54	36	3	4	-36	$\Sigma F_X X$	CORRECTIONS							
$F_X X^2$	54	132	54	—	54	72	9	16	346	$\Sigma F_X X^2$	$\frac{(\Sigma F_X X)(\Sigma F_Y Y)}{N}$ = -13.01							
$\Sigma F_{YX} Y$	-9.5	-24.	-2.5	+9	+71.5	+61.	+3	-3	(+85)	$\Sigma F_Y Y$								
$X\Sigma F_{YX} Y$	28.5	48.	2.5	—	71.5	122.	9	-12	290	$\Sigma F_{YX} XY$	$\frac{(\Sigma F_X X)^2}{N}$ = 5.51							
$(\Sigma F_{YX} Y)^2$	90.25	576.	529.	81	5112.25	3721	9	9										
$\frac{(\Sigma F_{YX} Y)^2}{F_X}$	15.04	17.47	9.80	1.29	86.45	266.22	9	4	399.47	$\Sigma\left[\frac{(\Sigma F_{YX} Y)^2}{F_X}\right]$	$\frac{(\Sigma F_Y Y)^2}{N}$ = 30.75							

$a = \Sigma F_{YX} XY - \frac{(\Sigma F_X X)(\Sigma F_Y Y)}{N}$ = +303.01

$b = \Sigma F_X X^2 - \frac{(\Sigma F_X X)^2}{N}$ = 390.49

$c = \Sigma F_Y Y^2 - \frac{(\Sigma F_Y Y)^2}{N}$ = 2091.3

$d = \Sigma\left[\frac{(\Sigma F_{YX} X)^2}{F_X}\right] - \frac{(\Sigma F_X X)^2}{N}$ = 98.70

$e = \Sigma\left[\frac{(\Sigma F_{YX} Y)^2}{F_Y}\right] - \frac{(\Sigma F_Y Y)^2}{N}$ = 224.22

$r_{XY} = \frac{a}{\sqrt{bc}}$ $\quad \eta_{XY} = \frac{\sqrt{d}}{b}$ $\quad \eta_{YX} = \frac{\sqrt{e}}{c}$

$\log b = 2.59161$
$\log c = 3.31833$
$\log \text{prod} = 5.90994$
$\log \sqrt{\ } = 2.95497$

$\log a = 2.48146$
$\log \sqrt{\ } = 2.95497$
$\log r = 9.52649$

$r_{XY} = +.3348 \pm .039$

$\log d = 1.92273$
$\log b = 2.59161$
$\log \frac{d}{b} = 9.33112$
$\frac{1}{2}\log \frac{d}{b} = 9.66556$

$\eta_{XY} = +.4632 \pm .025$

$\log c = 2.51094$
$\log c = 3.31833$
$\log \frac{e}{c} = 9.19261$
$\frac{1}{2}\log \frac{e}{c} = 9.59626$

$\eta_{YX} = +.3934 \pm .037$

PREPARED BY KARL J. HOLZINGER

by the use of logarithms. In continuing the arithmetic to obtain η_{yx} the steps are:

11. Square each item in the row designated $\Sigma' F_{xy} Y$, giving the quantities in the row designated $(\Sigma' F_{xy} Y)^2$.

12. Divide each of these last items by the corresponding F_x, and obtain the total $\Sigma\left[\frac{(\Sigma' F_{xy} Y)^2}{F_x}\right]$.

13. From this last result subtract the correction $\frac{(\Sigma F_y Y)^2}{N}$ (already found), giving e. (Similarly for d.) Only two new logarithms are needed to complete the work as outlined on the sheet.

Additional checks may be noted in parentheses on the form, viz.,

$$\Sigma F_x X = \Sigma(\Sigma' F_{xy} X), \quad \Sigma F_y Y = \Sigma(\Sigma' F_{xy} Y).$$

Probable errors are obtained from the formulas,

$$P.E.r = .6745\frac{1-r^2}{\sqrt{N}}, \quad P.E.\eta = .6745\frac{1-\eta^2}{\sqrt{N}}.$$

The practical criterion for linearity is

$$\frac{\sqrt{N}}{1.35}\sqrt{\eta^2 - r^2} < 2.5.$$

In order to illustrate the various steps, a model problem has been taken from Yule (p. 183). It may be noted that by Yule's plan it is necessary to square two place decimals, whereas by the short method, only the squares of integers are involved. The entire arithmetic for the three coefficients will take from one to two hours with a little practice.

In the mechanical make-up of the correlation sheet, the following points were kept in mind:

1. The size of the sheet should be convenient for filing. The form adopted is $8\frac{1}{2}$ by 11 when folded once.

2. There are 23×24 cells in the body of the table, which is a sufficient number for ordinary work.

3. The shape of the cell should be such that a five-place number may be written without crowding.

4. All important quantities should be so designated and the procedure so outlined on the sheet that no additional reference is necessary after one is familiar with the form.

FINAL REPORT

OF THE

JOINT COMMITTEE OF THE AMERICAN STATISTICAL AND THE AMERICAN ECONOMIC ASSOCIATIONS TO THE DIRECTOR OF THE CENSUS, 1922

To the American Economic and American Statistical Associations:

The Joint Committee appointed at the annual meetings of these associations held in December, 1918, to advise the Director of the Census concerning the Fourteenth Census of the United States, desires to supplement its reports of progress rendered in 1919, 1920, and 1921, with a final summary of its activities and to present for your consideration certain recommendations, made appropriate by the completion of the Fourteenth Census and hence the termination of the task assigned to us.

HISTORICAL PRECEDENTS

At the outset we invite your attention to the fact that there are interesting historical precedents for coöperation between scientific associations and the federal government. In particular the census has long been an object of great interest to statisticians and economists. The form and scope of census schedules, methods of enumeration, and details of tabulation have been of such vital importance to students of public affairs that the record of early memorials to Congress concerning the laws to provide for successive decennial enumerations and of definite coöperation to secure the best results in applying such laws suggests that the task assigned to your Committee at the beginning of the Fourteenth Census, although partly the outcome of that spirit of public and private coöperation induced by the war, was also in accord with historic precedent.

During the decade between 1790 and 1800, Sir John Sinclair, who brought the word *statistics* into general use in English, was publishing the twenty-one volumes of his *Statistical Account of Scotland.* As president of the newly established British Board of Agriculture, he continued the same policy in the effort to lay a broad basis for his projected *New System of Political Economy Founded on Statistical Researches.* Some echoes of this work spread across the Atlantic. The Connecticut Society of Arts and Sciences, organized in 1786, had been revived in 1799 as the Connecticut Academy of Arts and Sciences. It was founded after the plan of the American Philosophical

Society, which had originated at Philadelphia as early as 1743, and of the American Academy of Arts and Sciences, which had been started in Boston in 1780. The Connecticut Academy early became interested in Sinclair's results and undertook a similar work for Connecticut. The first of a projected series of publications on this subject was written by its president, Timothy Dwight.[1] The circular letter it sent out in 1800 asking others to prepare similar local studies ended: "In Scotland the first, and it is supposed the only, successful attempt of this nature has been carried into complete execution by a similar application to the clergymen and a few other enlightened persons in that country. It is rationally believed that an effort equally spirited and efficacious will be made in Connecticut: should this be the case, our state will have the honor of leading in this important field of knowledge."

The Connecticut Academy in the same winter made a second move to secure better statistical information. It sent to Congress a memorial on the subject of the approaching census and forwarded copies also to its elder sisters at Philadelphia and Boston with a request that they coöperate "in prevailing on Congress to direct the census to be taken in a more detailed manner."

The appeal of the Connecticut Academy to the Senate, signed by Timothy Dwight, in the light of subsequent events was a far-sighted and remarkable document. It expressed the belief "that to present and future generations it will be highly gratifying to observe progress of population in this country and to be able to trace the proportion of its increase from native Americans and from foreigners emigrating at successive periods." Then after specifying various other advantages likely to result from a detailed schedule, the memorial requested Congress to cover at the succeeding census the following inquiries: Age by nine periods classified by sex; number of persons foreign born; number in each hand occupation; in trade; farmers; professional men by professions; and marital condition, all classified by towns, cities, and other geographic areas.

Little by little the ground staked out in this noteworthy request of the Connecticut Academy was covered in later decades as the census schedules expanded.

The American Philosophical Society, through a committee consisting of its president, Jefferson, and its vice presidents, Wister, Patterson, and Rush, sent a memorial of similar tenor to the United States Senate, then in session at Philadelphia, and forwarded copies of this memorial to the Academies at New Haven and Boston.

[1] *Statistical Account of the City of New Haven*, 1811.

The improvement in the census upon which both of these memorials laid the greatest emphasis was a detailed classification of the population by ages, in the expectation that it would throw light upon the average duration of human life in the United States. The report of the discussions in Congress does not mention these memorials, but the law for the census of 1800 differs from that of ten years earlier mainly in regard to age classification. The president of the Philadelphia Society was also vice president of the United States and in a position to press the suggestion upon the attention of the Senate, over which he presided, so we are perhaps warranted in assuming that the modification of the law was due to the influence of these societies. However that may be, the white population at the census of 1800 was classified by sex and five age classes, or ten classes in all.

The next thirty years brought no important development in the American census, but in the decade between 1830 and 1840 there was more statistical advance than in any of its predecessors or immediate followers. Two statistical societies—one permanent and the other abortive—were organized in the United States; the germ of a state system of vital statistics was established in Massachusetts; and in that state the group of statists forming the American Statistical Association did much to encourage the development of statistics. Through a committee it sent a memorial to Congress dealing especially with errors in the returns of education and of the enumeration of deaths at the census of 1840. The House Committee, to which the memorial was referred, reported that it "destroyed the utility of the printed census so far as the subjects referred to are concerned."

Perhaps the most important improvement in the whole history of the American census was made in 1850, by which the unit of enumeration became the individual instead of the household, and a number of statistical questions were asked for every resident of the country. This innovation, introduced into the United States by the Boston census of 1845, was suggested probably by the Irish census of 1841. In any case, its introduction was due to an original member of the American Statistical Association, Lemuel Shattuck, who had charge of the Boston census of 1845 and headed a committee of the American Statistical Association to draft a plan for the Federal Census of 1850. Later Shattuck was invited to Washington to aid the government in preparing a plan for the census of 1850, and five out of its six schedules were drafted by him. This radical improvement in the Federal Census was due mainly to a member of the Statistical Association and was advocated first by a committee which he had suggested and of which he was the moving spirit.

The American Statistical Association, which is much the older society, was thus the first to enter this field, but within the last generation the American Economic Association has done fully as much to improve the federal census. A paper read before the younger society in 1895 on the "Desirability of a Permanent Census Bureau" led the two associations to appoint coöperating committees which petitioned Congress to establish a permanent bureau. Not content with this appeal the American Economic Association under the same leadership subsequently appointed a committee "to inquire into the scope and method of the Eleventh Census with a view to determining what ought to be attempted at the Twelfth." This committee brought forth an octavo volume of 500 pages, containing 20 essays by as many authors, reviewing various aspects of the work of the preceding census (and its secretary was subsequently connected with the taking of the census of 1900[1]).

It should be added that coöperation between scientific organizations and the government occurs also in Great Britain, where the Royal Statistical Society, the parent body of the American Statistical Association, as recently as the last census of Great Britain, coöperated with the government by making certain recommendations for improvements in the census of 1921 in the form of a report. These recommendations will be found in the *Journal of the Royal Statistical Society* of January, 1920. This is in accordance with the precedent long since established of recommendations by the Society before the taking of a decennial census.

There is thus ample historical precedent for the coöperation of associations such as those represented by your Committee in connection with the taking of the federal census and also for representation by scientific societies concerning the form of presentation of census results.

WORK OF THE JOINT COMMITTEE

The activities of the Committee from its organization February 10, 1919, up to the last annual meetings of these two associations held at Pittsburgh, December, 1921, have been described in three written reports and need not be repeated.

During the past year, 1922, four meetings were held as follows:

February 17–18
April 28–29
June 23–24
November 10–11

[1] W. F. Willcox: "Development of the American Census Office" in *Pol. Sci. Quart.* XXIX: 438 (Sept., 1914).

The entire number of meetings held by the Committee from 1919 to 1922 inclusive, was 26, besides which there have been several meetings of sub-committees in New York and Boston. These gatherings, especially during the administration of Director Steuart, were organized as systematic conferences between census officials and the members of the Committee. Here were discussed in orderly fashion the problems of the Bureau, and definite recommendations were made wherever such action appeared likely to be helpful. The problems put before the members of the Committee have been many and serious, and in dealing with them the Director of the Census has shown a consistent desire to make the most of the assistance offered him by the two associations through their Joint Committee. This coöperation has been made especially effective by the fine esprit de corps in all grades of the personnel of his bureau which the present Director has developed. At each of these meetings nearly all the members were present, though often attendance represented great personal inconvenience. The sessions of the Committee were held at the Bureau of the Census, and usually extended over two days, generally including evening sessions. Meetings were called upon intimation to the chairman that matters for discussion had accumulated of sufficient consequence to justify summoning the members to Washington. In this way the Committee followed and passed opinions upon the different steps of census taking, tabulation, and publication, and advised concerning the character, scope, and format of the published reports.

During the past year, as heretofore, the recommendations of the Committee have covered a variety of subjects. It will be noted that as the work on the decennial census approached completion a considerable portion of the Committee's resolutions have been concerned with intercensal inquiries. The recommendations submitted during the year numbered 28, and will be found appended to this report. They represent, however, but a small part of the advisory suggestions made to the Bureau, many of which were informal.

SUMMARY OF CENSUS WORK

We consider the achievements of the Census Bureau in complying with the time requirements of the Fourteenth Census Act in the face of extremely adverse conditions a noteworthy one.

Probably few persons other than those connected with the census realize the magnitude of the undertaking and the difficulties of carrying it to completion within the period prescribed by law. It involves the printing and distribution of 25,000,000 schedules of questions; the organization and supervision of a force of over 90,000 enumerators and

special agents employed to make a house-to-house canvass of the entire United States—including all the outlying possessions except the Philippines and the Virgin Islands—and to fill out schedules for 107,500,000 people, 6,500,000 farms, 450,000 manufacturing establishments, and 22,000 mining and quarrying enterprises; the examination, checking, and editing of the schedules when received; the punching of 300,000,000 tabulation cards; the running of the equivalent of over 2,500,000,000 cards through electrical sorting and tabulating machines; the computation of about half a million percentages, averages, and other rates; the preparation of elaborate manuscript tables; and, finally, the printing and publication of 11 quarto volumes with an aggregate of nearly 12,000 pages.

The enumeration was begun on January 2, 1920, and the first completed population schedules were received on January 15. By the end of February more than half of the schedules had reached the Bureau, and by the end of April more than nine-tenths. On the first of July, however, there were still 245 districts from which returns had not been received, and it was not until October 7 that the last schedules had come in and the Bureau was in a position to make the preliminary announcement of the total population of the United States. In the meantime, however, the population totals for the various states, counties, cities, villages, townships, etc., had been announced as rapidly as the count was completed, the first announcement, that for the cities of Washington and Cincinnati, having been made on February 21.

The examination and editing of the population schedules followed closely upon their receipt. The task of editing at this census was made peculiarly difficult because of the recent changes in the geography of Europe, as a large part of the work consisted in checking or verifying and correcting the answers to birthplace questions in order to make sure that they related to the countries of Europe as defined at the present time.

The first step in the process of machine tabulation was the punching of the cards. This work was begun in March, 1920, and practically completed before the end of October. The day force engaged on the card punching reached a maximum of over 700 operatives, averaging not far from 500. A night force was employed part of the time.

The next important step was the machine verification, made to test the accuracy of the card punching. This was begun in April, 1920, and practically completed in November. The actual machine tabulation, involving four machine sorts of the cards and six runs through the tabulating machines, was begun in August, 1920, and was completed in October, 1921.

At this census for the first time the occupation data were punched on a special card distinct from the population card, thereby making it possible to carry on the tabulation of occupations simultaneously with that of the other population data, with the result that the complete copy for the occupation report was in the hands of the printer before the termination of the census period.

For the first time in the history of the census all the agricultural data were tabulated by the use of punch cards and electrical tabulating machines. To cover all the items on the comprehensive agricultural schedule it was found necessary to use 17 sets of cards. The aggregate number of cards punched was over 140,000,000. The census of manufactures was likewise tabulated for the first time by the use of the punch card and electrical tabulating system. The machine tabulation for the census of agriculture was completed in June, 1921, and that for manufactures in January, 1922.

The first publication of the census results was through press summaries, mimeographed or sometimes printed and given out to editors, newspaper correspondents, and others. The series of press announcements issued at this census as rapidly as the tabulation of the data permitted covered total population, race, sex, nativity, country of birth for the foreign-born white, illiteracy, age, occupational classes, number of farms, farm acreage, farm values, crops, domestic animals, number of manufacturing establishments, number of wage-earners employed, cost of principal materials, value of products, and other subjects. In all, the Bureau issued over 12,000 press summaries.

In their complete and permanent form, most of the statistics were first issued in bulletins which were later bound together as volumes of the final reports. The scheme of publication at this census provided for six series of state bulletins: two for population, one for agriculture, one for manufactures, one for irrigation, and one for drainage. The first series of population state bulletins, giving the number of inhabitants by counties, cities, townships, etc., was completed in April, 1921, about six months earlier than the date of completion of the corresponding series for the census of 1910. The second series, covering sex, race, nativity, age, illiteracy, and school attendance, citizenship, and dwellings and families, was completed and published by November 17, 1921; the series for agriculture by January 30, 1922. All the other state bulletins had been either published or forwarded to the public printer before the termination of the census period.

By June 30, 1922, the date which marked the termination of the three-year decennial census period, the manuscript and statistical tables for all the reports required for the Fourteenth Decennial Census

had been sent to the printer, and all the fundamental statistics and many detailed figures had been published as bulletins or advance statements.

The decennial census work necessitates an enormous temporary increase in the office force employed in Washington. At the beginning of the census period, July 1, 1919, the total force numbered 779. Within the next twelve months it was increased to more than 6,000. It reached a maximum of 6,301 by the end of August, 1920. Thereafter, it had to be gradually reduced as the successive stages of the work were completed, until at the end of the period, on June 30, 1922, it numbered only 831. This rapid expansion and subsequent reduction of the office force involves in itself an administrative task of no little difficulty. The total number of appointments and reappointments made during the census period was over 14,000. These figures do not include appointments of supervisors, enumerators, and other temporary employees for field work, amounting in all to more than 100,000 field appointments of various kinds.

The total cost of carrying on the work of the Census Bureau during the Fourteenth Decennial Census period was approximately $23,000,000. This includes the cost of annual and other inquiries carried on during this period but not forming a part of the decennial census. The total amount expended was about half a million less than the amount appropriated.

The Census Bureau has established a record in census taking. Not only has the tabulation been completed within the time required by the law, but the Bureau has met and fully satisfied the demand for prompt publication. So far as this census is concerned, the charge cannot be made that the figures published are ancient history. Beginning a few months after the field canvassers started work and continuing until the close of the census period, there issued from the Bureau a constant stream of statistical information in the form of press announcements and bulletins; and these advance publications have covered every feature of the census. So it is safe to say that never before has the public been supplied with such an array of facts concerning the elements of our population, their social condition, and their industrial activities, so shortly after the data were collected.

Moreover, at no preceding census have there been encountered so many serious obstacles. This was the first census ever taken in midwinter, and the weather, especially in the northern states, was unusually severe, so that the work of enumeration, particularly in the rural districts, was greatly hampered. Another handicap resulted from the fact that the census was taken at a time when, because of the

prevailing high salaries, wages, and prices, it was extremely difficult to secure competent persons to accept employment as enumerators at the relatively low rates of pay which the Bureau of the Census was able to offer.

When due consideration is given to these obstacles and to the gigantic character of the undertaking itself, it is no exaggeration to say that the completion of the census within the short period of three years is a remarkable achievement.

CENSUS MONOGRAPHS

The Committee has especial pleasure in inviting the attention of the two associations to the fact that the Director of the Census cordially approved our recommendation to establish a series of monographs dealing with important subjects of the census. It was the earnest opinion of your representatives that the haste necessary in connection with the production of census volumes made it impossible to interpret adequately any of the more important changes indicated by the census returns. In following the general policy outlined by the Committee to omit practically all text from the census reports in order to concentrate on the tables, the Director thus cordially adopted the other portion of the recommendation that especial weight should be thrown on a group of publications which might become standard reference books, not necessarily technical in style, and which it was believed would form a real advance in the presentation of census material. Naturally the Committee has been deeply interested in the development of this idea, has participated in the endeavor to secure the most competent experts to prepare reports upon the titles selected, and has counselled from time to time both with the Bureau and with the authors. The list of publications so far determined is as follows:

Increase of Population in the United States 1910–1920. . W. S. Rossiter
Illiteracy and School Attendance . . . . . Frank A. Ross
Growth of the Mining Industry . . . . . G. A. Roush
Immigrants and Their Children . . . . . Niles Carpenter
Growth of Manufactures . . . . . Edmund E. Day
Farm Mortgages . . . . . Jesse E. Pope
Earnings of Industrial Workers . . . . . Paul F. Brissenden
Centralization of Industrial Operations . . . . . W. L. Thorp
Farm Tenancy in the United States . . . . . E. A. Goldenweiser
Children at Work . . . . . Alba M. Edwards
Women at Work . . . . . O. M. Riddleberger
The Woman Home-Maker . . . . . Bertha M. Nienburg

All of these monographs are well under way; the first is completed and about to appear from the Government Printing Office, and it is hoped that all of them will be published before the end of the present fiscal year. These books, in accordance with the policy urged by the Committee, will be of large octavo size (7 x 10) and will be published in both paper and cloth binding at a nominal price.

PRACTICAL VALUE OF THE COMMITTEE WORK

Your Committee assumes that the members of the American Statistical and the American Economic Associations desire to know what distinct and practical service, if any, was rendered to the Federal Census Bureau by their representatives during the Fourteenth Census period just ended. Of what value was this venture in coöperation between two scientific associations and an important government undertaking? Was the appointment of such an advisory body justified, and what definite impress, if any, have these two associations, through their joint committee, left upon the taking and tabulating of the census and in the printed pages recording census results?

The following letter addressed to the chairman of the Joint Committee for submission to the two associations answers in part these queries:

My dear Mr. Rossiter:

The Advisory Committee having now finished the specific work for which it was appointed by the American Statistical and Economic Associations, I wish to express my appreciation of its valuable assistance in connection with the difficult task of taking the Fourteenth Decennial Census of the United States. The members have always responded readily to every appeal I have made, coming to Washington for frequent meetings, offering helpful suggestions, and giving careful thought and their best judgment to the questions on which I have sought their advice. The success of the Fourteenth Census is in no small degree attributable to their assistance.

It seems to me that there is every reason why the Statistical and Economic Associations should make this committee permanent. While there is no single statistical task as vast as the decennial census and none perhaps equally important, yet the other statistical inquiries regularly carried on by the Census Bureau are hardly inferior in importance and in the aggregate hardly less in magnitude. There is, therefore, a continuous need for an advisory committee in connection with the work of the permanent Bureau. Many new projects or plans for statistical inquiries will come up for consideration from time to time; of the inquiries already instituted some are new and still in the formative stage, and the long established inquiries are not so standardized and perfected that they cannot be improved. In fact, it seems to me that the usefulness of a committee composed of representative economists and statisticians to advise and assist the Director of the Census in extending and perfecting the work of a national statistical office is too obvious to require argument. The service such a committee renders is not alone nor primarily a service to me. It is a service to the members of the associations represented by the committee and other similar associations; and more than that, in view of the vital importance of having

statistical data on social and economic questions accurately compiled and well presented, it is a service to the people and to the nation.

I hope, therefore, my dear Mr. Rossiter, that you will not fail to urge upon the members of the Economic and the Statistical Associations, as you may have opportunity, the desirability of instituting a permanent advisory census committee. While the two associations have always taken an active interest in the census, manifesting it by recommendations, by memorials to Congress, and, sometimes, by criticism, this establishment of an advisory committee is the first step taken for practical coöperation with the Bureau. To abolish this coöperation now that it has been established or suffer it to lapse would in my opinion be a backward step.

Very truly yours,

W. M. STEUART,
Director.

Acceptance of the Director's suggestion that the associations continue the Joint Committee would foster their coöperation in the growth of the census and lead to an increased emphasis upon the scientific side of federal statistics. It would also represent a great advance in systematic and permanent coöperation between scientific associations and the federal government, going far to realize the ideals of a century ago referred to earlier in this report.

With the acceptance of this report your Joint Committee considers its task completed, unless the two associations see fit to accept the cordial suggestion of the Director of the Census, and continue and reorganize the Committee.

METHOD OF PERPETUATING THE COMMITTEE

At the meeting of the American Statistical Association at Pittsburgh in December, 1921, the resolution accepting the Joint Committee report of progress approved the idea of a permanent committee and directed the representatives of the Statistical Association on the Joint committee to recommend a plan to that end.

In view, therefore, of the fact that the Statistical Association voted a year ago in favor of formulating plans to establish a permanent joint coöperation with the Census Bureau, and in view of the formal request by the Director of the Census, herein presented, that this committee be made a continuing body, we recommend the adoption by both associations of the following resolution:

WHEREAS the coöperation between the Bureau of the Census and the American Statistical Association and the American Economic Association, established by the appointment in 1918 of a joint committee of three from each association to advise with the Director of the Census during the Fourteenth Census period, has proved of such practical value to the Bureau that the Director of the Census has requested the continuation of such joint committee as a permanent body, therefore,

Resolved, that the report of the present Joint Committee be accepted as a report

of progress, and that the resignations of the representatives be and hereby are accepted, and

Resolved, that this Association approve the creation of a permanent joint advisory committee to the Director of the Census to consist of six members, three of whom shall represent this Association, and three to represent the ——— Association, and said three representatives of this Association shall be and hereby are constituted a standing committee of this Association, and,

Resolved, members of said joint committee representing this Association shall be appointed by the Board of Directors for terms of one, two, and three years respectively. Members shall be eligible for reappointment. Election of representatives of this Association upon the newly constituted joint committee shall take place on or before January 15, 1923, and thereafter the annual vacancy shall be filled at the meeting of the Board of Directors immediately preceding the Annual Meeting of this Association.

FUTURE CENSUS NEEDS AND POSSIBILITIES

Among the needs and possibilities of the future which demand the interest and support of the two associations are the following:

Mechanical Equipment

The Joint Committee attempted at the outset of its coöperation with the Bureau to induce the Director to complete the equipment for mechanical tabulation of census returns by obtaining a machine punch which should compare favorably with the splendid sorting and tabulating machines already developed and owned by the Bureau. This was not done, and 150,000,000 cards in the Division of Population were punched by hand as they had been twenty years before. Comparisons with the experience of the Division of Agriculture, where up-to-date commercial equipment was used, indicate that the hand process took twice as many clerks and cost almost twice as much as machine punching would have done. No such waste of money and painful human effort should ever be allowed to occur again. A committee like this can doubtless aid the Bureau in the future to take early measures to effect the desirable changes in mechanical equipment which continued advances in the art in commercial practice render possible.

Development of Vital Statistics

Within the twenty years since the establishment of a permanent Census Bureau and largely as a result of its efforts, the registration of deaths has extended from one state to another until now it includes four-fifths of the country's population under an effective system. Within the five years since the Bureau began to compile and publish the statistics of births that system has come to include three-fifths of the country's population. This office also at irregular intervals has issued reports upon the statistics of marriage and divorce.

All four branches of vital statistics should become nation-wide and the figures should be made public in annual reports. No other kind of work done by the Bureau is of more far-reaching importance. The figures should receive thorough and detailed interpretation. If the Chief Statistician is prevented by other demands upon his energies from adequately working that field with his present staff, he should be supplied with trained and competent assistance.

Taking a Census of Mercantile Enterprises

We have gradually developed in the United States statistical reports covering most of the major branches of business. Periodical censuses are taken of agriculture, mining, and manufacturing, which the Departments of Agriculture and the Interior supplement with annual data concerning the production of the farms, forests, mines and quarries. Banking is covered by the Comptroller of the Currency, the railroads and express companies by the Interstate Commerce Commission, all on a yearly basis. At intervals reports are made by the Bureau of the Census upon street railways, light and power plants, and telegraph and telephone companies. Shipping is covered both by the Census and by the United States Shipping Board. The fisheries have a bureau all their own.

On one of the greatest of national interests, however, we have no accurate information—the distribution of commodities by wholesale and retail merchants. The census has never entered this field, and the lack is supplied by no other agency. Yet there are more people employed in trade, according to the Census of Occupations, than in transportation, or in all the professions put together. The public, moreover, has been much exercised of late over the costs which it pays for distributing goods, and over changes in merchandizing methods and agencies. Is it not high time that the fundamental facts about mercantile enterprises be ascertained?

The Advisory Committee hopes that Congress will soon direct the Bureau of the Census to take a periodical census of mercantile enterprises. The field is difficult to cover (though probably less difficult than the manufacturing field already cultivated with success) and it would doubtless be wise to begin with a simple schedule. The inquiries might be limited to the name of the enterprise, its legal form, the character of goods dealt in, the number of wage and salary earners by months, the total payroll, the aggregate cost price paid for goods, the aggregate selling price received, and perhaps a few other items.

It is believed that the results obtained by the first enumeration of

mercantile enterprises would be worth far more than the cost, while the experience gained could be utilized to improve the plan for subsequent inquiries.

Census in Relation to Centralization of Statistics

The question of the centralization of governmental statistical work and the place of the Census Bureau in such a reorganization has been discussed at intervals during the last two years in Washington. The problem has been brought on several occasions to the attention of the Committee but it has not been called upon to make any thorough study of the matter. An extensive, though intermittent, experiment of the actual conditions of statistical services in Washington warrant, however, a few observations.

To those who from a distance see government reorganization as a problem primarily of logical grouping on a chart, who find statistical bureaus or statistical activities scattered and unrelated in a large number of departments, with apparent overlapping, duplication of function, and waste of equipment, it seems natural to approve of a regrouping under the general direction of the Census Bureau as the central and permanent statistical agency of the national government. There is, indeed, much to be said in favor of the gradual accretion in strength, authority, and independence of the Census Bureau, but as things stand today a great and sudden increase in the responsibilities of an already somewhat cumbrous and scientifically understaffed Bureau might react unfavorably and impede that fuller development which to most professional statisticians seems desirable. It should also be remembered that there is, in fact, less duplication of work and less waste of statistical facilities than a superficial survey might seem to indicate. Many of the decentralized statistical bureaus are organically connected with the departmental administrations which they respectively serve, and might, if detached, lose some of their effectiveness.

The advantage of close departmental contact could be retained and at the same time the advantage of coöperation be secured by some such mechanism as a Council or Statistical Clearing House, with the Director of the Census acting as Chairman. To bring this about and to secure its continued and effective operation, the authority of the President or of his representative, the Director of the Budget Bureau, might possibly be required. Such an arrangement would link the Statistical Clearing House or Council to that organization which is directly responsible for administrative efficiency and coördination among all the federal agencies. The Committee, however, does not

take upon itself the responsibility of recommending this or any other definite machinery of reorganization. It merely suggests that in making a beginning of centralization, a federation of agencies under competent leadership would be more likely to bring about a willing cooperation and a practical coördination of resources than a more mechanical and authoritative amalgamation.

The Committee further suggests that those who have the future welfare of the Census Bureau at heart should be less concerned for any immediate increase of size and authority and more for securing such appropriations as may enable it to attract to its service the best professional ability. The growth of the Census Bureau in scientific authority should precede its further physical expansion.

Wealth, Debt, Taxation, and Financial Statistics

With reference to the report on Wealth, Debt, and Taxation, the Committee is of the opinion that the statistics to be collected should be more comprehensive than in the past. On the question of debt we have hitherto had no figures at all for many of the minor civil divisions which are invested with the power of issuing bonds. In order to present an accurate picture of the situation as it exists, the figures should include all these minor civil divisions.

The same observation holds true of the question of revenues. It is quite impossible to estimate the burden of taxation, *per capita* or otherwise, resting upon the people of the United States, if we limit the statistics to the states, the municipalities, and to the villages and towns of 2,500 population and over. Not alone should the smaller hamlets be included, but also the numerous other tax-levying districts, of which a great variety is found in not a few of our states. In the separate commonwealths themselves, only a very few collect or present statistics of that kind, so that there is at present no comprehensive statement of the subject to be found anywhere in the United States. This is a situation which ought to be remedied.

The subject of expenditures has not been treated in the preceding decennial censuses, although the annual volumes on Financial Statistics of States and Cities do include that topic. There is no reason why expenditures should not be included in the decennial census. On the contrary, there is every reason why they should be so included. If that is done, it might be advisable to change the general title of the volume from *Wealth, Debt, and Taxation*, to *Wealth, Debt, Revenues, and Expenditures*, or *Wealth, Debt, and the Budget*, or *Wealth and Public Finance*, or something of that kind.

Format

Early in the discussions concerning the form of publication of the Fourteenth Census, the Committee reached the unanimous conclusion that the octavo size of page as compared with the quarto would be far superior both for the convenience of students and as permanent books of reference on library shelves. In this opinion the Director of the Census heartily concurred, but there were evident certain practical difficulties. It remained to be proved by experiment whether the census tables could be adapted to the smaller page without impairing their value and clarity. It was therefore evident to the Committee that it would be unwise to urge the adoption of a format which might lead to delay and great embarrassment and expense without sufficient experience in advance under favorable conditions to determine definitely whether this radical change could be effected without detriment to the Bureau. Accordingly, the Committee contented itself with earnestly recommending to the Director of the Census that he avoid the error into which previous administrations had fallen in issuing the results of a decennial census by reducing the weight of the paper used in the quarto volumes of the Fourteenth Census to a degree of thinness which would represent a weight consistent with reasonable convenience in handling. It was believed that with the recommendations which had already been accepted by the Director for the practical elimination of text from the main reports the recommendation concerning paper would result in a series of volumes, which, though large as to number of pages, would nevertheless be so light as to permit of convenient handling. This recommendation of the Committee was adopted, and the reports of the Fourteenth Census show a marked difference in the details indicated from those of previous modern censuses.

It was further agreed by the Committee and the Director that it would be advisable to try the experiment of the octavo size on intercensal reports in order that the advantages and defects might be developed by a practical test. The Bureau is planning to follow this suggestion, and during the intercensal period it can be definitely determined whether the octavo size is feasible for the main reports of the federal census, and this subject so long discussed by those who are interested in census reports will at last be definitely decided. It is to be earnestly hoped that the decision will be in favor of the octavo size. If this is the case and these volumes in turn can be printed on thin paper of a somewhat better quality than that used on Fourteenth Census reports, the census reports instead of being a burden both to bookshelves and to students will be a small, compact, handy, invalu-

able series, of such convenient size that they can be available on even limited library space.

Agricultural and Biennial Censuses

The participation by the United States in the great war occurred during the latter part of the decade. This emphasized the fact that in the second half of a decade information secured decennially is of comparatively little value for practical purposes. In consequence, the War Industries Board and other temporary war organizations made hasty collections of figures in connection with the various industries, and depended largely upon these superficial inquiries for the data required in connection with war work, rather than upon the older census figures, which were useful only as a background and a means of checking against possible error. This undoubtedly led directly to the inclusion in the law authorizing the Fourteenth Census of a provision to make a biennial inquiry concerning manufacturing industries. Congress had previously authorized a five-year inquiry upon agriculture, but this had not been made. The Bureau was, moreover, engaged—and had been for some time—in collecting annually statistics of cotton production, vital statistics, and returns of fiscal operations of cities. There has thus been built up within a comparatively short time a body of statistics within the Bureau collected much more frequently than on the original decennial basis. This tendency seems to be increasing. A step indeed still further in advance is the *Survey of Current Business*, which is published monthly. The Director of the Census is following a wise policy in making the schedules as simple as possible for these more frequent inquiries. The schedule for the biennial census of manufactures (now approaching completion) was submitted to the Committee, and it was largely on the authority of the representatives of these two associations that the pressure to secure detailed information was resisted. In connection with this changing status of certain census inquiries, it may prove advisable to urge upon Congress the necessity of making an appropriation to take a census of agriculture as directed by Section 31 of the Act of March 3, 1919, providing for the Fourteenth and subsequent censuses. The subject of enumerations more frequent than decennial is likely to demand considerable thought in the future.

The Director of the Census

The Committee would be decidedly failing in its duty as it presents the final report of its connection with the Census Bureau if it made no reference to the unfailing courtesy and unusual capacity of the present

Director of the Census. A great change has come over the relation of the Census both to other branches of the government and to the country, in the last decade or two. The Bureau is no longer an independent unit engaged in making inquiries authorized by Congress and for which ample resources from an abundant treasury are easily obtained. Its earlier activities were largely routine and comparatively few appeals were made to the Bureau by the public, except for special bits of information. At the present time the Bureau is merely a small part of a department presided over by a man of strong personality to whom all matters must be referred for decision. It is engaged in making all manner of inquiries, many of which, as already pointed out, are on an annual or biennial basis; it is compelled to deal with Congress, which is now going to the farthest extremes of economy in connection with the permanent activities of the government; finally, the Bureau is besieged with problems submitted by great numbers of persons having awakened interest in social, statistical, and economic matters, who are now beginning to realize that the federal census is a great statistical organ for their use. Thus at the present time the Director of the Census must be not only a man having statistical knowledge, but also a man skilled in the precedents of the government: of infinite patience, and of great tact and diplomacy. It is our duty no less than our pleasure to report to the two associations that these qualities are combined to a high degree in the present Director of the Census, Mr. William M. Steuart.

The Committee has thus submitted a final record of the activities undertaken by your direction. It has outlined the more important problems likely to confront the Bureau in the future, and transmitted the cordial expressions of the Director of the Census upon the practical value of coöperation with these associations. The Committee now respectfully reports that the task assigned to it has been completed, and invites discharge.

REPRESENTING THE AMERICAN STATISTICAL AND THE AMERICAN ECONOMIC ASSOCIATIONS:
WILLIAM S. ROSSITER, *Chairman*
CARROLL W. DOTEN
EDWIN F. GAY
WESLEY C. MITCHELL
EDWIN R. A. SELIGMAN
WALTER F. WILLCOX
ALLYN A. YOUNG

December 1, 1922

APPENDIX.

Resolutions Adopted by the Joint Advisory Committee of the American Statistical and Economic Associations.

91. In regard to the financial statistics of cities of over 30,000 and states, the Committee thoroughly endorses the judgment of the Bureau that it is impracticable to secure satisfactory results from data supplied by the local city officials or by simply collating the statistics furnished in the annual financial reports of cities. The Committee strongly recommends, therefore, that the former method of collection be resumed, namely, collection by the agents of the Bureau and based upon detailed schedules.

92. The Committee recommends that the cities and states which have not furnished information for the year 1921 shall be immediately canvassed by the agents of the Bureau in order to prepare a report for that year comparable with previous reports, but that no statistics of this character be collected for the year 1922 in view of the fact that a complete census upon wealth, debt, and taxation will be taken for the year 1923. The Committee will present recommendations defining a more permanent policy to the Director of the Census at a later meeting.

93. The Committee recommended the publication of the report on occupational mortality with explanations of the method by which the figures were reached and the rates prepared, but with no attempt to interpret these rates. The Committee was of the opinion that the results of the inquiry into occupational mortality for 1920 might advisably be presented with a considerable degree of fullness, but that comparisons with the year 1910 should be restricted to comparable areas, to selected causes of death, and to selected occupations.
In the opinion of the Committee the publication of press bulletins on the occupational mortality in advance of the publication of the final report on that subject would be unwise.

94. The Committee recommends that the Chief Statistician for Vital Statistics be asked to check the births and the infantile deaths with the population schedules in the District of Columbia for the year preceding the enumeration of 1920.

95. The Committee is of the opinion that short-method life tables, based on mortality in the years 1919 and 1920 and population in January, 1920, should be constructed. It does not, however, believe it necessary or advisable for the Bureau to undertake the construction of a series of life tables by more elaborate methods, utilizing the results of the census of 1920.

96. The Committee recommends that the schedules and so much of the pertinent parts of the instructions as may not appear in the text be included in an appendix to one of the volumes on each of the main subjects of the census.

97. The Committee recommends that the Director of the Census prepare for insertion in Volume II of the census reports, the center of population of the following: Negro, foreign-born, native white of native parentage; and that the preparation of the center of population of the separate states and of all other centers should be contingent upon approval of the preparation of a Statistical Atlas by Congress.

98. It is recommended that the numbers 2 and 8 on the list of press summaries of vital statistics be omitted.

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99. The Advisory Committee favors encouraging coöperation between the Census Bureau and cities and states looking towards the taking of satisfactory local censuses in the interval between successive Federal censuses; it approves the plan of coöperation outlined in the Director's letter with reference to the proposed census of Detroit and recommends that the Bureau place its facilities as far as practicable at the disposal of any local government disposed to undertake such censuses.

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100. The Committee is of the opinion that a special investigation of mortgages on homes other than farm homes should be undertaken in not less than five selected localities in widely separated parts of the country with a view to testing the representative character of the information derived from the special mortgages schedule.

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101. The Committee recommends that the Director of the Census secure such information as it is possible to obtain regarding mortgages upon rented farms, by distributing a limited number of circulars of inquiry to the owners of such farms.

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102. It is recommended that a sub-committee of three, consisting of Professor Young, Chairman, Mr. Gay, and Professor Doten, be appointed provisionally to coöperate in connection with the Statistical Abstract.

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103. It is moved without definite committal on details, that the Committee approves the general purpose of Mr. Mallory's plan. It is recommended that Mr. Mallory ask the Secretary for an appointment of a Committee for a conference to consider the organization of a Business Service in more detail.

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104. The Committee recommends that all experts employed to prepare monographs, but not working in the Bureau, be instructed to report to the Director of the Census on the last day of each month concerning the amount and character of work actually performed in order to justify approval by the Director of vouchers for compensation.

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105. The Committee is of the opinion that the Bureau of the Census may advisably undertake to collect price statistics and to construct comprehensive index numbers of prices. It believes, however, that it would be unwise to add new index numbers to those now published by other government agencies unless the new index numbers are so constructed as to serve purposes not otherwise adequately met. In particular it suggests that the Bureau's index numbers should ultimately have, so far as practicable, the following qualities: (1) They should be based on prices actually paid rather than on "Quotations." (2) They should be comprehensive in scope. The price series collected should be numerous and so distributed as to make it possible to construct index numbers both for different groups of industries and for different geographical sections. (3) The prices paid in primary and in other markets should be differentiated. (4) In some cases, prices for strictly comparable goods should be obtained from original producers or manufacturers, from wholesale dealers, and from retail

merchants. (5) Both contract and market prices should be collected in trades where there is a significant difference between these two types of quotations. (6) The results should be published promptly.

106. The Committee approves the policy outlined in the Director's letter to Mrs. Thomas G. Winter and others, under date of April 25. While the tabulation of data relating to the domestic status of women not gainfully employed would yield interesting and important results, the cost would be prohibitive. The Committee recommends, however, that additional facts be secured relating to the domestic status of women at work.

107. The Committee recommends that the census publish as speedily as practicable a bulletin or short monograph, with maps, presenting state and national centers of population, and national agricultural and manufacturing centers by separate crops, industries, and other customary units.

108. The Committee is much gratified to learn that the Director of the Census finds that his funds remaining from the census period will be sufficient to permit the publication of a statistical atlas. They welcome the publication of this volume as being extremely valuable to workers in history and statistics, and recommend to the Director that he advance the publication of this work as rapidly as possible.

109. The Committee recommends that the Director of the Census, with the approval of the Secretary, transfer the population census schedules, which together constitute an invaluable national record, from the Department of Commerce Building, where the storage conditions are extremely unsatisfactory, and a fire recently occurred destroying certain of these records, to the Census Bureau, where they can be under the immediate supervision and care of the Director. The Committee is impressed with the necessity of having an archives building erected as quickly as possible so that the census and other valuable records of the Government may be made convenient of access and safely and properly stored.

110. The Committee recommends that in publishing the report upon wealth, debt and taxation the Director consider very carefully the advisability of conforming to the early Committee recommendations concerning the publication of the census reports in octavo form and make such experiments as may be necessary to enable him to conform to that recommendation.

111. The Committee recommends that instead of attempting to secure statistics of marriage and divorce for the year 1921 beginning the preparation at this period after six months of the year have elapsed, that it would be a better policy for the census to begin preparations for this inquiry now, with a view to utilizing the year 1922, obtain the information as speedily as possible after January 1, and to publish the report prior to the first of July, 1923.

112. The Committee recommends that the Director publish the information concerning states as separate pamphlets or bulletins, following the general plan adopted at the Thirteenth Census of collecting as one publication for each state the information from the different volumes of the census.

113. It is recommended that the Census Report on Wealth, Debt, and Taxation include a comprehensive statement of all the tax revenues of all the minor civil divisions in the respective states.

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114. In order that work upon the coming investigation of wealth, debt, and taxation may be begun at once, the Committee recommends that the fiscal year covered in the investigation be made the twelve months ending December 31, 1922, or the first period closing prior thereto. So far as assessed valuation, tax levies, and estimated wealth are concerned, this shift would involve no change from the practice followed in the last previous investigation. So far as relates to indebtedness, revenues, and expenditures, the Committee is informed, the shift from a fiscal year closing in the twelve months ending June 30 would lead to the use of the figures of a different fiscal year for only 20 or 25 per cent of the subdivisions included.

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115. Having discussed with the Director, Mr. Grogan, Mr. Hole, Mr. Carruthers, and Dr. King, the plans for taking the decennial census of wealth, the Committee approves the statement of "principles to be followed in evaluating the national wealth" submitted by Dr. W. I. King, and further recommends to the Director that the census be based upon an evaluation of physical wealth.

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116. Having discussed with the Director, Mr. Grogan, Mr. Carruthers, Mr. Hole, and Dr. King, the plans for taking a decennial census of wealth, debt, and taxation, the Committee holds that it is highly desirable to obtain complete returns of the revenues, expenses, and indebtedness of all administrative units provided that the expense be not excessive. The Committee approves the administrative scheme devised by the Director of using a single set of agents to obtain data regarding institutional population, marriage and divorce, and electrical industries at the same time as they collect data regarding government finances. But recognizing that despite this scheme, the cost of extending the financial inquiries to the smaller administrative units may still prove heavy, the Committee recommends that the Director select sample counties and try out the plan of collecting full data in practice before deciding definitely upon the procedure to be followed in taking the Census of Wealth, Debt, and Taxation.

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117. Having discussed with the Director and the Chief Statistician of the Division of Population their tentative plans for taking the census of institutional population consisting of feeble-minded and insane persons, the Advisory Committee cordially approves of the procedure in view and particularly of close coöperation between the Bureau of the Census and the experts of the Mental Hygiene Association.

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118. The Committee cordially approves the arrangement by which the Bureau is to furnish the Division of Geology and Geography of the National Research Council photostat copies of maps of counties crossed by important physiographic boundaries, showing minor physical divisions. Such coöperation with organizations engaged in furthering scientific research, the Committee believes, is likely to bear fruit in the better interpretation and increased usefulness of the results of the census.

THE INEQUALITY IN THE DISTRIBUTION OF WEALTH AND INCOME IN THE UNITED STATES

In the *Final Report of the Commission on Industrial Relations* [1] there appears the statement: "The 'rich,' 2 per cent of the people, own 60 per cent of the wealth." In the report of the National Bureau of Economic Research on "The Income of the United States" [2] appears the statement: "In the same year (1918), about 60 per cent of the national income was divided among the 86 per cent of the gainfully employed who had incomes less than $2,000 per annum, and about 40 per cent of the national income was divided among the 14 per cent of the gainfully employed who had incomes exceeding $2,000." In Mr. M. C. Rorty's book, entitled, *Some Problems in Current Economics*,[3] the statement is made that 68 per cent of the national income was received for salaries, wages, and personal service, about 24 per cent for return on capital, and about 8 per cent for rents of natural resources.

Thus, side by side appear statements to the effect that the bulk of the wealth is owned by the few, but that the bulk of the income is shared by the many. On the one hand, it is stated that if all large incomes were equally distributed among the masses the average income would not be increased more than 25 per cent, and that the decline in the productivity of our society which wholesale confiscation would entail would more than counterbalance this temporary gain; on the other hand, it is pointed out that a relatively few individuals not only enjoy the richest rewards but exercise the dominant controlling influence over our modern industrial society. So far no one has reconciled these apparently conflicting statements. The result is that the man who wants to soothe the workers uses one set of figures and the man who wants to inflame them uses the other set, and an impartial critic wonders which is right.

As a matter of fact, both statements are correct, but a coupling statement is necessary to clear up the apparent discrepancy.

It is obvious that most of the smaller incomes are largely spent for consumable goods, and that they therefore afford little surplus for wealth. On the other hand, the possessors of the largest incomes find it impossible to spend their fortunes, and they are obliged to accumulate more and more wealth, willy-nilly. It is therefore only the surplus income over the cost of living that really counts at all from the standpoint of wealth or power. Accordingly, if we take the 58 billion dollar income which 37,500,000 income receivers enjoyed in 1918, and if we appropriate the entire surplus over $2,000 (without making good the deficiency of the income receivers getting less than $2,000 per annum), we would get a sum of 12.5 billion dollars. Part of this 12.5 billion dollars and a major portion of the remaining 45.5 billion dollars is spent for food, clothing, rent, etc., or in maintaining the wear and tear of the human element. This 12.5 billions and its distribution is the crucial thing to be considered from the standpoint of wealth or economic power, even as the 58 billion dollars is the significant thing

[1] Government Printing Office, 1915, pp. 23–31.
[2] New York: Harcourt, Brace & Howe, 1921, p. 146.
[3] A. W. Shaw Co., 1922.

from the standpoint of consumption and purchasing power. How, then, is this surplus which gives to some comforts, to others luxuries, and to still others power, distributed? In 1918, 843,000 income receivers, or 2.2 per cent of the total number, received 71 per cent of this surplus, while only 256,000 persons, or two-thirds of 1 per cent of the income receivers, obtained 50 per cent of the same surplus. This result tallies closely with the statement that 2 per cent of the people own 60 per cent of the wealth.

What is the conclusion that is to be drawn from these parallel figures? It is true, on the one hand, that the average worker will gain but little from an equal distribution of all income, and that the productivity of industry would probably decline so much on account of the diminution of capital savings that even the worker would lose this slight gain. It is also true, on the other hand, that wealth and economic power are already greatly concentrated, and that if this concentration proceeds to grow greater under any system of distribution, no matter how just, the time will come when the masses, mediocre and shiftless though they be, will demand a new deal. In the Lorenz curve of distribution of wealth the line of equal distribution is a straight line, bisecting the right angle formed by a verticle axis of percentage of total income and a horizontal axis of percentage of persons beginning with the poorest. The actual curve of distribution of income sags heavily from the straight line, while the actual curve of the distribution of wealth presses still more closely upon the horizontal axis. Push this curve further and further in toward the center and there is likely to be an explosion, as there has been in all past systems of concentration. Therefore, by heavy inheritance taxes, the curve of distribution should be straightened out until it more nearly approaches a straight line. In this way we should tend to maintain industrial equality even at the expense of capital accumulation.

HOMER HOYT

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LAW OF GROWTH IN FORECASTING DEMAND

In his article in the December, 1922, issue of this JOURNAL, Mr. Prescott uses an empirical formula to represent a series of observations which evidentially are not functional. The population in a given territory has its normal functional growth, and added thereto are such fortuitous increments as may accrue from time to time. Such fortuitous increments as immigration which may be cut off by legislative act must not be smothered in empirical formulas. If they are, they serve only to lead the user of such formulas astray.

All induction is from the specific to the generic. If we can segregate a single variable we have a rational simple function. More often it is impossible to segregate down to single variables. In such cases we are forced to take groups. Here two courses are open: Either construct a rational formula based on several variables, or use an empirical formula based on a single selected variable. With experimental data, neither uniform nor accurate, it is increasingly difficult to predicate a rational formula on many variables. At the same time, the values of a rational function are so much greater than the empirical that every effort

in such direction must be made. An empirical deduction may not be used except under the conditions from which it was deduced. It may not be extended beyond the limits of observation. A rational function is true in extension and in combination. The curve of population offered is one constructed to take into account the accelerated falling off of annual increment of population. Growth generically is an exponential function. We may take the generic formula for population growth as

$$P = Ar^y.$$

When P = population at end of y years
A = population at base year
r = annual increment ratio.

With normal conditions of fecundity, health, and hygiene, the annual increment would be constant. If such is erratic, a series of ratios should be substituted for a single ratio with exponent of years.

Extraordinary additions or subtractions are not growth proper, and they should show as a separate rational factor. If a war had reduced the population 5 per cent, such displacement in the growth curve should show as a distinct displacement. If the conditions before and after such a war were normal and regular, the population would still vary as the year power of the annual increment ratio. But the base would be changed. The base A must be diminished by the amount of the war deletion. In plotting such results we should have two curves functionally the same, displaced the one from the other by amount of the war deletion.

Now supposing the conditions above were constrained into an empirical expression in curve or formula, what would be the result? Clearly, after the war the population would be smaller than the values given by the pre-war formula. The pre-war formula must be modified by some form of diminishing function. And—here great emphasis is laid—in such case, if the diminishing function is made to predicate the results immediately succeeding the war, all future values from the curve extended will be increasingly too small when compared with actual observations. The empirical function developed here by constraining the war deletion into a general function results in a formula that is not rational to the variables, and, secondly, cannot be used beyond the points from which it was calculated.

The curve with the diminished increment aspect is grossly subject to the above criticisms. The symmetrical character of the curve with respect to time, entailing an increasing and decreasing function, is ridiculous when population is considered. Also, the maxima and minima present a situation that are not commensurate with a growth formula.

The reason for these results is not hard to see. The population in continental United States has not been entirely augmented on a functional basis. Part of the increment has been by immigration. With the additive increment the true growth feature of the population is violated, and the population total is a sum of a growth function with a non-functional and variable increment added. Now this immigration increment through time and legislation restrictions and

war has been less. It therefore has been necessary to put in a diminishing aspect to the increasing growth function in order to predicate empirically from the actual results.

Such constraint entails the modification of the true growth formula to include first the additive immigration increment and, second, to provide for the decreasing annual amount of such increment. In order to follow the function of the resulting law, after the diminishing feature had equalled in amount the immigrant element, emigration would be necessary in order that the curve be vindicated.

In short, it may be stated that while within the limits of errors of observation the curve as presented may fairly represent the data on which it is based, it is worthless for extension or for use as showing the functional growth.

If, in fact, it is known that a variable additive increment is a part of the population increase, the formula had better take such into account and be stated as

$$P = A(r_1\, r_2\, r_3\, r_4 \quad . \quad . \quad . \quad r_y).$$

Such a formula is easy of calculation and of use. If a functional aspect for a given period of years is desired, it is far more accurate to take the year root of the product of the annual ratios for such period than to depend upon a rational function constrained to meet a non-functional element.

JOHN BALCH BLOOD

INFANT MORTALITY IN AUSTRALIA

The Commonwealth statistician, Mr. C. H. Wickens, has just completed an investigation concerning the Australian rates of mortality for children under the age of five years during the decade 1911–20. These results indicate that the general improvement in such rates experienced during the thirty years prior to 1911 was continued during the succeeding decade, and that the rates of 1911–20 are probably lower than those for any other country in the world, with the single exception of New Zealand.

The following table gives the rate of mortality during each of the first five years of age per 1,000 for males and females who entered upon such age, and furnishes a comparison of the results for 1911–20 with those for the three preceding decades:

ANNUAL MORTALITY PER 1,000

Year of age	1881–90		1891–1900		1901–10		1911–20	
	Male	Female	Male	Female	Male	Female	Male	Female
Birth to 1	132.5	115.7	118.4	101.4	95.1	79.5	75.2	60.5
1 to 2	34.9	33.5	26.4	24.8	17.8	16.7	15.0	13.3
2 to 3	13.7	13.3	9.8	9.6	6.8	6.3	6.4	5.8
3 to 4	8.9	8.3	6.3	6.2	4.4	4.1	4.2	3.9
4 to 5	6.9	6.5	5.0	4.9	3.5	3.2	3.2	3.2

At all the ages under 5, with the single exception of the year from 4 to 5 in the decennium 1911–20, the female mortality was lighter than the male. The superiority of female infant life over male varies with the age; it is most marked in the first year of life. Thus, for the decennium 1911–20, the female rate of mortality was only 80 per cent of the male for the first year, increasing to 90 per cent in the second, 91 per cent in the third, 93 per cent in the fourth, and 100 per cent in the fifth year. These tables indicate clearly the marked and continuous improvement in Australian infant mortality during the past forty years.

The results may be presented in a somewhat different form, one which gives a clearer view of the reduction in loss of infant life during the forty years. Thus, the following table gives for males and females the number who would be found surviving at ages 1, 2, 3, 4, and 5 out of 100,000 born, if these were subject to the rates of mortality experienced on the average in the four decades under review:

SURVIVORS AT EACH AGE OUT OF 100,000 BORN

Age	1881–90		1891–1900		1901–10		1911–20	
	Male	Female	Male	Female	Male	Female	Male	Female
0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
1	86,752	88,428	88,160	89,861	90,490	92,047	92,476	93,952
2	83,722	85,463	85,836	87,635	88,879	90,515	91,088	92,702
3	82,577	84,330	84,998	86,796	88,280	89,946	90,504	92,167
4	81,845	83,630	84,466	86,262	87,892	89,576	90,123	91,809
5	81,281	83,090	84,047	85,842	87,585	89,285	89,838	91,517

These figures indicate that whereas in 1881–90 approximately only 81 per cent of the male children born reached age 5, 84 per cent reached this age in 1891–1900, 88 per cent in 1901–10, and 90 per cent in 1911–20. Similarly of the female children born, approximately only 83 per cent reached age 5 in 1881–90, whereas 86 per cent reached age 5 in 1891–1900, 89 per cent in 1901–10, and 92 per cent in 1911–20.

A striking result disclosed by the last table is the relatively small variation from decade to decade in the excess of female survivors at age 5 out of every 100,000 born over the corresponding male survivors. Thus, in 1881–90 there was a female excess of survivors of 1,809; this excess was 1,795, in 1891–1900; 1,700 in 1901–10; and 1,693 in 1911–20. The excess of female survivors tends to counterbalance the preponderance of male births which is observable in birth statistics all over the world.

REPORT OF THE COMMITTEE ON THE MEASUREMENT OF EMPLOYMENT

The initiative for the appointment of this committee came from several directions. A member of the American Statistical Association who was collecting employment statistics for the Illinois Department of Labor, Mr. R. D. Cahn, brought to the attention of the Association at its annual meeting in 1921 the

difficulties encountered by a statistician in a state department of labor because of competition between several governmental bureaus, all collecting similar data. For instance, in Chicago at that time employment statistics were being gathered by the Illinois Department of Labor, the Federal Bureau of Labor Statistics, the United States Employment Service, and the Federal Reserve Bank of the district, not to mention the state and federal departments which were collecting statistics on mining. As a result of this experience Mr. Cahn urged upon the Association the appointment of a committee to standardize the work. At about the same time the President's Conference on Unemployment had come face to face with the difficulty of measuring the extent of unemployment and its geographical or industrial distribution, because the data gathered by both federal and state agencies were insufficient to give a safe basis for conclusions.

The need illustrated by these two experiences was recognized by the very large group of persons interested in the problem of unemployment, and the Board of Directors of the American Statistical Association therefore authorized the appointment of a committee. The object of the Board, as stated by its secretary, was: "To promote a study of the methods of gathering, checking, analyzing, and presenting the facts of employment, and a study of how far standard forms and methods are possible in meeting the needs of those who seek this information." The committee was composed of statisticians of state and federal bureaus who were collecting data on employment, and users of these statistics whose thorough study had given them a basis for suggestions for their greater effectiveness.[1]

At about the same time the Committee on the Business Cycle, appointed by Secretary Hoover after the adjournment of the President's Conference on Unemployment, planned as part of its work a study of statistics of employment as an index of the business cycle. The Committee of the American Statistical Association has served in an advisory capacity in this phase of the work of the Committee on the Business Cycle; and in the report on Unemployment and Business Cycles, prepared by the National Bureau of Economic Research under the direction of Wesley C. Mitchell, appears a chapter entitled "Charting the Course of Employment," which embodies the experience and suggestions of the Committee on the Measurement of Employment of the American Statistical Association.

[1] The membership of this committee is as follows: A. J. Altmeyer, Secretary, Industrial Commission of Wisconsin; Charles E. Baldwin, Chief Statistician, U. S. Bureau of Labor Statistics; Joseph A. Becker, Statistician, Bureau of Agricultural Economics, U. S. Department of Agriculture; W. A. Berridge, Assistant Professor of Economics, Brown University; R. D. Cahn, Statistician in Charge, General Advisory Board, Illinois Department of Labor; Frederick E. Croxton, Assistant Professor of Economics, Ohio State University; Ralph G. Hurlin, Director, Division of Statistics, Russell Sage Foundation; Don D. Lescohier, Professor of Economics, University of Wisconsin; Max O. Lorenz, Director, Bureau of Statistics, Interstate Commerce Commission; Eugene B. Patton, Chief Statistician, New York Department of Labor; Roswell F. Phelps, Director, Division of Statistics, Massachusetts Department of Labor and Industries; W. H. Steiner, formerly Acting Chief of the Division of Analysis and Research, Federal Reserve Board; W. W. Stewart, Director, Division of Analysis and Research, Federal Reserve Board; F. G. Tryon, in charge of Coal and Coke Statistics, U. S. Geological Survey; Leo Wolman, New School for Social Research; Mary Van Kleeck, Chairman, Director, Department of Industrial Studies, Russell Sage Foundation.

When the committee began its work the Federal Bureau of Labor Statistics was receiving monthly reports of numbers employed and total wages paid in a limited number of industrial establishments throughout the country. Only two states, New York and Wisconsin, were coöperating by the collection of identical information within their own borders, with reports to the federal bureau from as many establishments as were needed for the national data. Regarding agriculture, no comparable statistics were being gathered, and facts about employment on the railroads, although available in comprehensive form through the Interstate Commerce Commission, were not combined with information about other industries in any one bureau of the government. The committee therefore conceived its task to be two-fold: (1) To decide on the basis of its experience what facts should be gathered and what their scope should be, industrially and geographically; and (2) to urge the collection of these facts extensively enough to give a basis for determining the trend of employment in important industries throughout the country. This task, it will readily be seen, deals with problems which are more administrative than statistical in their nature.

The work of the committee has not yet been completed, and it is therefore only possible at this time to outline its suggestions in tentative form as a basis for discussion.

1. That a uniform schedule be adopted as the standard, containing the facts now asked for by the Federal Bureau of Labor Statistics and by New York, Wisconsin, Illinois, and Massachusetts; namely,

(a) Total number of wage-earners on the payroll including the period covering the 15th of the month;

(b) Total wages paid in the same period.

2. That the Federal Bureau of Labor Statistics be the coördinating center and that data collected by other federal agencies, such as the Interstate Commerce Commission and the Geological Survey, and by state bureaus, be reported promptly to the federal bureau to be combined with all available statistics on employment for publication in one report.

3. That as rapidly as possible states not now collecting these figures, particularly in the Far West, the Northwest, and the South, be urged to join in the plan.

4. That promptness of publication is of the utmost importance in making these statistics useful, and that to insure it extraordinary efforts be put forth to eliminate delays in the original reporting by firms, and that state and federal printing offices be urged to give precedence to the publication of this information while it has current significance.

5. That consideration be given by the Federal Bureau of Labor Statistics to the possibility of classifying by states, or by geographical zones other than states, the data which they now publish for each industry as a whole.

6. That thorough study be given to the influence upon statistics on employment of the transfer of wage-earners from one type of work to another. Is employment in manufacturing industries a fair index? This is a question which can be answered only if state and federal bureaus include enough occupations

in the periodic collection of statistics to make possible comparison by them. In order of feasibility of collecting the figures, and significance from the point of view of control of the business cycle, the committee suggests the following list of industries to be included in the collection of employment statistics: (1) Manufacturing (divided into its main industrial groups in accordance with a uniform classification which remains to be adopted); (2) mining and quarrying; (3) transportation and other forms of communication; (4) building and other construction; (5) wholesale trade; (6) retail trade; (7) logging; (8) agriculture.

7. That attention be given especially to the importance of uniform classification of manufacturing industries, since without it it is impossible to combine the data gathered by different bureaus.

The Department of Agriculture has promised its coöperation in the purposes of the committee and stands ready to collect statistics of employment on the farms as soon as a feasible plan can be worked out for measuring so elusive a subject as the number of men employed at any given time in agriculture.

The outstanding problems to which the committee intends to direct its attention in the immediate future are:

1. The inclusion of statistics on agriculture.
2. Extension of employment statistics to a sufficient variety of other occupations to give a fair picture of conditions of employment in all important industries.
3. Adequate representation of different geographical areas.
4. Uniform industrial classification, especially in manufacturing industries.
5. Most important of all in the view of the committee, the working out of methods for more prompt reporting and publication of the facts.

REPORT ON THE BUSINESS-CYCLE DINNER

A special meeting of the American Statistical Association was held on Friday, December 13, at the Machinery Club in New York City, to discuss the subject, "Evidence for the Business Cycle, Its Length, Amplitude and Regularity." The purpose of the meeting was to bring together in summary form the findings of different investigators into various phases of the business cycle, with a view to discovering the significant points of agreement and difference as to the basal facts of the cycle.

The discussion was opened by Dr. Wesley C. Mitchell, Director, National Bureau of Economic Research, and Professor Edmund E. Day, Harvard University. Discussion was continued by Professor William F. Ogburn, Columbia University, Mr. Seymour L. Andrew, American Telephone and Telegraph Company, Professor Philip G. Wright, Institute of Economics, Washington, D. C., Professor William L. Crum, Yale University, Dr. Frederic R. Macaulay, National Bureau of Economic Research, Mr. Donald R. Belcher, American Telephone and Telegraph Company, Dr. Edmond E. Lincoln, Western Electric Company, Professor Irving Fisher, Yale University, and Dr. H. Parker Willis, Columbia University. The presentation of evidence by the speakers was supported by numerous graphic charts exhibited about the hall.

Much of the evening's discussion took the direction of defining the business

cycle, and most of the speakers seemed to be in general agreement as to the kind of thing the cycle is. Professor Fisher pointed out two possible views which might be recognized—the mechanical view and the historical view. The mechanical view would find in the business cycle such a precise rhythm in the movement of business as the swing of the pendulum. This view would be to the effect that each fluctuation in business brings its reaction in the mathematical, mechanical fashion, which one might expect from a series of events due directly to causes in nature itself.

It was clear that the speakers of the evening did not hold this theory of the business cycle. The statistical evidence presented was to the effect that the business cycle does not repeat itself with the uniform regularity of an astronomical movement which may be described by a mathematical equation. Dr. Mitchell phrased it, "Like all historical phenomena, each cycle is, strictly speaking, a unique phase of human experience." The business cycle was defined not in terms of uniformity of length or amplitude, or by strict regularity of occurrence, but by the general sequence of events which characterizes cycles. To quote again from Dr. Mitchell, whose statement may fairly be taken as representative of the position of a number of the speakers: "To me the business cycle means a round of developments in the realm of business, a series of business phenomena which returns upon itself."

In discussing the length and amplitude of the business cycle a number of differences between the conclusions of the different speakers came into evidence. The investigations of the Harvard Bureau show a length of cycle approximating forty months. An annual index of business computed by Professor Ogburn showed an average length of cycle of about six and one-half years. An index of general business conditions computed by the American Telephone and Telegraph Company pointed to three and one-half years as the typical length. These differences, however, were in part due to the fact that the different investigators were summarizing different periods of time. All were in agreement that the general averages which they cited could in no sense be taken as indicative of the exact duration of any cycle. The cycles of the past have varied widely in the length of time consumed in their different movements.

Concerning the amplitude of the cycle or the amount of fluctuation that has taken place in business activity at different phases of the cycle, the speakers presented much less definite evidence. It was clearly recognized that the amplitude of movement which any index shows is determined largely by the type of data included in the index. The production of basic materials in general fluctuates much more widely than the manufacture of goods entering more rapidly into consumption: wholesale prices fluctuate more widely than retail prices. As yet no method has been devised for measuring the movement of the whole of business so precisely that one can state the percentage of fluctuation which occurs. It was variously estimated at a range of from 5 to 10 per cent above normal to 5 to 10 per cent below normal. Comment was made by a number of speakers on the characteristic shape of the business cycle curve. Business activity falls off rapidly in periods of depression, while the recovery from depression to prosperity is comparatively slow.

The differences between the points of view of the different speakers in regard to the business cycle were most strikingly apparent when the discussion centered on the causes of the business cycle. Dr. Mitchell suggested the use of business profits as the general framework into which might be fitted the various investigations of the business cycle, with the thought that such a framework might show the relation of each phase of movement to the whole. Professor Fisher found chief significance for the interpretation of the cycle in real interest, which in turn is largely a function of changes in price level. Professor Wright sought for explanation of the elements of the cycle in psychological factors. Here again, however, the speakers were at one in recognizing that the cause of the cycle is still a matter of conjecture.

In regard to the practical utility of studies of the business cycle two of the speakers, Dr. Mitchell and Professor Macaulay, drew an analogy between the study of the business cycle and the study of price index numbers. Only a few years ago many statisticians and economists were doubtful of the value of price index numbers. Many believed that the movements of individual prices were so diverse that it was impossible to conceive of anything in the nature of a general level of prices. In recent years, however, the value of price index numbers has been almost universally recognized. It seems entirely possible that as our knowledge becomes more comprehensive and exact, studies of the sequential movements in business may have similar value.

PROCEEDINGS OF THE EIGHTY-FOURTH ANNUAL MEETING OF THE AMERICAN STATISTICAL ASSOCIATION

CHICAGO, ILL., DECEMBER 27–29, 1922

PROGRAM

Wednesday, December 27

2.30 P.M.—First Session (Joint Meeting with the American Economic Association)
Topic: The Outlook for 1923
Paper: Probable Trend of Level of Prices and Cost of Living,
Allyn A. Young, Harvard University
Paper: Probable Trend of Rate of Interest and Investment,
H. Parker Willis, Columbia University
Paper: Probable Trend of Wages and Employment,
Alvin H. Hansen, University of Minnesota
Discussion:
Wesley C. Mitchell, Columbia University
Walter W. Stewart, Federal Reserve Board
Mary Van Kleeck, Russell Sage Foundation

8.00 P.M.—Second Session (Joint Meeting with the American Economic Association and the American Sociological Society)
Presidents' Addresses:
The Adventure of Population Growth,
W. S. Rossiter, American Statistical Association
Company v. Trade Unions,
Henry R. Seager, American Economic Association
The Moral Dualism of Machiavelli,
J. P. Lichtenberger, American Sociological Society

10.00 P.M.—Smoker

Thursday, December 28

10.00 A.M.—Third Session

Topic: The Increase of Population

Paper: Population and the World War,
Walter F. Willcox, Cornell University

Paper: Population Facts for the United States and Their Interpretation,
Warren S. Thompson, Scripps Foundation for Research in Population Problems, Miami University, Oxford, Ohio

Paper: Agricultural Resources of the United States and the Trend of Population,
Oliver E. Baker, Bureau of Agricultural Economics, Department of Agriculture

Discussion:
Edward A. Ross, University of Wisconsin
Frank A. Fetter, Princeton University
Richard T. Ely, Institute for Research in Land Economics, Madison, Wis.
Louis I. Dublin, Metropolitan Life Insurance Company, New York City

2.00 P.M.—Fourth Session. (A Round Table Discussion) Conducted by Malcolm C. Rorty, American Telegraph and Telephone Company, New York City

Topic: Standards of Training and Practice in Statistics

The proposed discussion has two purposes:

1. To determine specifically, for the principal fields of statistical applications, what knowledge of methods should be acquired in preparation for the work to be done
2. To secure a consensus of opinion among representative academic and practicing statisticians as to the desirability of securing the preparation of a standard series of statistical reference works for the use of statisticians

It is proposed to have a series of ten-minute papers under the following headings:

1. Logical Fallacies in the Use of Quantitative Data
   Harry C. Carver, University of Michigan
   Joseph E. Pogue, Consulting Engineer, New York City
2. Methods and Training Required in Business and Economic Research
   William A. Berridge, Brown University
   Carl Snyder, Federal Reserve Bank, New York City
3. Fundamental Requirements in Demography and Insurance
   Edwin W. Kopf, Metropolitan Life Insurance Company, New York City
4. Methods for Quantitative Work in Psychology and Education
   Karl J. Holzinger, University of Chicago
5. Mathematical Principles Underlying Statistical Methods
   Robert W. Burgess, Brown University
6. What Training is Available at Present?
   Seymour L. Andrew, American Telephone and Telegraph Co., New York City
   James A. Field, University of Chicago
7. A Plan to Improve Training and Technique
   Leonard P. Ayres, Cleveland Trust Co.
   Louis I. Dublin, Metropolitan Life Insurance Co., New York City

5.00 P.M.—Business Session. (Brief meeting to hear certain reports of Officers and Committees)

Friday, December 29

9.00 A.M.—Final Business Session
Election of Officers and action on reports

10.00 A.M.—Fifth Session (Joint Meeting with the American Association for Labor Legislation)

Topic: Progress in Extending and Standardizing Employment Statistics in the United States

Paper: The Geographical Distribution of Industries as a Factor in Statistics of Employment and Earnings
Don D. Lescohier, University of Wisconsin

Paper: Proposals for Improvement of Statistics of Employment and Earnings in the United States
Mary Van Kleeck, Russell Sage Foundation

Discussion:
Charles E. Baldwin, Federal Bureau of Labor Statistics
Walter W. Stewart, Federal Reserve Board
Henry C. Taylor, Department of Agriculture

Discussion from the viewpoint of the consumers of employment statistics:
Richard S. Conway, Brookmire Economic Service

NOTE: The Committee of the Association on the Measurement of Employment, under whose direction this meeting has been planned, has prepared a *graphic exhibit* to emphasize some important factors and relations in *statistics of employment and earnings.*

MINUTES OF THE ANNUAL BUSINESS MEETING

President William S. Rossiter presided at the business session on Friday morning, December 29, at the Congress Hotel, Chicago, Ill.

Reports were submitted as follows:

REPORT OF THE SECRETARY FOR 1922

The following report is submitted with respect to the condition of the Association:

Membership, December, 1921		946
Additions during 1922	148	
[1] Deductions during 1922	108	
Net gain during 1922		40
Membership, December, 1922		986
Besides members we have:		
Subscribers, mostly libraries		283
Domestic exchanges		26
Foreign exchanges		76
Total members, subscribers, and exchanges		1,371

The death of the following members has been reported during the year: Dr. Jaques Bertillon (Honorary Member), C. Edward Billquist, Edward M. Hartwell (Fellow), F. A. Roper, A. Gordon Tait.

Four numbers of the JOURNAL have been issued during 1922, the first half of Volume XVIII, a total of 560 pages. Beginning with the June issue five pages have been devoted to advertising in each issue. The charge for space has been at the rate of $25 a page for each issue. The Secretary has had charge of securing the advertisements.

Four special meetings of the Association have been held in New York City

[1] Above deductions are distributed as follows:

Deaths reported during 1922	5
Resignations during 1922	65
Dropped because unable to locate	9
Dropped for non-payment of dues	29
	108

during the year. The attendance was 120, 105, 60, and 350 respectively. At the last meeting, on December 15, Business Cycles were discussed, and the meeting attracted more than usual attention both among our own membership and among persons outside the Association.

ROBERT E. CHADDOCK, *Secretary*

REPORT OF THE TREASURER FOR 1922

Receipts

Membership dues		$4,318.53
Sales, single copies of the JOURNAL		379.45
Sales, Memorial Volume:		
Sales direct to members	$119.00	
Sales through Macmillan Co.	145.04	
Total		264.04
[1] Advertising in JOURNAL, June and September		225.00
Subscriptions to the JOURNAL		1,546.05
Dividends on B. & A. Stock		148.75
Balance on hand from 1921		153.67
		$7,035.49

Expenditures

Printing:		
Printing the JOURNAL:		
Balance due on September, 1921, issue		$500.00
December, 1921		793.23
March, 1922		1,015.30
June, 1922		915.78
September, 1922		830.57
Authors' Reprints for December, 1921 to September, 1922 inclusive		237.35
Total printing the JOURNAL		$4,292.23
Other printing, stationery, etc.		310.66
Total printing		$4,602.89
Postage		312.12
Salaries		1098.22
Payment in full, Memorial Volume Loan		400.00
Expenses, miscellaneous		269.66
Balance on hand, December 19, 1922		352.60
		$7,035.49

[1] The Board authorized the use of 5 pages of each issue at $25 a page. This policy began with June issue.

REPORT ON MEMORIAL VOLUME FUND, 1922

Receipts

Sales to members at special rate ($3.50)	$119.00
Sales through Macmillan Company	145.04
Deficits for 1920, 1921, and 1922, which are met from general funds	616.15
	$880.19

Expenditures

Deficits for years 1920 and 1921	$480.19
Payment of $400 loan in full	400.00
	$880.19

Payable

The Association owes the Rumford Press about $300 for printing, etc., on account of the new Handbook issued with the September JOURNAL as a supplement. There are more than sufficient funds in the Treasurer's hands to meet all obligations.

Assets

Seventeen shares of Boston and Albany R. R. stock. Approximately 350 copies of the Memorial Volume still unsold.

ROBERT E. CHADDOCK, *Treasurer*

REPORT OF THE AUDITING COMMITTEE

We have audited the accounts of the Treasurer of the American Statistical Association as of the close of business on December 16, 1922. We find these accounts in excellent condition. All disbursements are properly accounted for by cancelled checks and vouchers. We have verified the Treasurer's record of receipts and disbursements, as shown by his books, and find them in agreement with the record of bank deposits and the cash balance on hand as shown by the bank statement.

As is customary, we have made no audit of accounts payable and receivable.

RALPH G. HURLIN,
W. RANDOLPH BURGESS,
Auditing Committee

The reports of the Secretary-Treasurer and of the Auditors were approved and ordered printed in the proceedings.

REPORTS OF COMMITTEES

The Joint Advisory Committee on the Census

The detailed final report of the Joint Advisory Committee appears on pages 628–49 of this issue. At the annual meeting in Pittsburgh, 1921, the representatives of the Association on this committee were requested to recommend a plan for the permanent organization of this committee at the next annual meeting. In accordance with this request the following resolutions were submitted:

WHEREAS, the coöperation between the Bureau of the Census and the American Statistical Association and the American Economic Association, established by the appointment in 1918 of a joint committee of three from each association to advise with the Director of the Census during the fourteenth census period, has proved of such practical value to the Bureau that the Director of the Census has requested the continuation of such joint committee as a permanent body, therefore,

Resolved, that the report of the present Joint Committee be accepted, and that the resignations of the representatives be and hereby are accepted, and

Resolved, that this Association approve the creation of a permanent joint advisory committee to the Director of the Census to consist of six members, of whom three shall represent this Association and three shall represent the Economic Association, and said three representatives of this Association shall be and hereby are constituted a standing committee of this Association, and

Resolved, members of said joint committee representing this Association shall be appointed by the Board of Directors for terms of one, two, and three years respectively. Members shall be eligible for reappointment. Election of representatives of this Association upon the newly constituted joint committee shall take place on or before January 15, 1923, and thereafter the annual vacancy shall be filled at the meeting of the Board of Directors immediately preceding the annual meeting of this Association.

The final report of the Joint Committee was accepted and the resolutions providing for a permanent continuing committee were adopted.

In view of the scope and volume of the work of this committee during the past three years, the skill with which its recommendations have been presented to the government officials, and the great extent to which these suggestions have been adopted in the policies of the Director of the Census in reference to the fourteenth census, and in other matters connected with the Department of Commerce, the Association hereby expresses to the individual members, and especially to the Chairman of the Committee, Mr. W. S. Rossiter, who has devoted untiring personal effort to the success of the work and has exercised rare tact in accomplishing its purposes, the deep appreciation of our membership for a noteworthy achievement in coöperation between these scientific societies and the government.

Committee on Fellows

Carroll W. Doten, Chairman, reported for record the agreement of his committee in electing the following members as Fellows of the Association, as provided in Article V of the Constitution: Willard C. Brinton, R. H. Coats, James A. Field, Arne Fisher, David Friday, J. Arthur Harris, F. Leslie Hayford, Don D. Lescohier, Roswell F. Phelps, Joseph E. Pogue, Horatio M. Pollock, H. O. Rugg, Edgar Sydenstricker, Fred G. Tryon, G. P. Watkins, Leo Wolman.

Committee on Institutional Statistics

The Chairman, Dr. Horatio M. Pollock, Statistician of the State Hospital Commission of New York, presented the following report:

Your Committee on Institutional Statistics submits herewith a report of its various activities during the past year together with some notes relative to the progress of institutional statistics.

The Committee held two meetings during the year, both of which were attended by a majority of the members. The work of planning a system of statistics for institutions for children which was started last year was continued and nearly completed. Schedule cards for the use of such institutions have been prepared and a set of statistical tables to be compiled from such cards has been outlined. A manual explaining the cards and tables and giving the various classifications to be used in preparing the data has been arranged and is nearly ready for the printer.

The Committee is indebted to Miss Georgia Ralph, of the Committee on Statistics of the National Conference for Social Work, and to Mr. Wm. C. Hunt, of the Federal Census Bureau, for attendance at its meetings and for many helpful suggestions.

The Committee has taken no action with reference to the introduction of its statistical system in institutions for children, but it feels that such action should be taken during the coming year. It is believed that the coöperation of the Federal Census Bureau, the Federal Children's Bureau, and the National Conference for Social Work and other organizations interested in promoting good records in institutions for children can be secured.

The Committee notes with pleasure that a federal census of institutions throughout the United States is to be taken as of December 31, 1922. The schedule cards for taking such census, which members of this Committee assisted in preparing, will include important inquiries not used in previous censuses. Among these may be mentioned an inquiry as to the form of mental disease of patients in institutions for the insane, and the degree of mental defect of patients in institutions for the feebleminded. The compilation of these data has been made possible through the uniform system of statistics that has been introduced in these institutions during the past four years.

A Committee of the American Institute of Criminal Law and Criminology is making a study of criminal statistics and hopes to be able to introduce system and uniformity in this most neglected field.

This report was accepted and approved.

Committee on Employment Statistics

The Committee on Employment Statistics was appointed by the Board of Directors of the Association early in 1922. Its purpose was defined by the Secretary as follows:

"The object of the Board was to promote a study of the methods of gathering, checking, analyzing, and presenting the facts of employment, and a study of how far standard forms and methods are possible in meeting the needs of those who seek this information."

The membership is as follows:

Altmeyer, A. J., Industrial Commission of Wisconsin
Baldwin, Charles E., U. S. Department of Labor

Becker, Joseph A., U. S. Department of Agriculture
Berridge, W. A., Brown University
Cahn, R. D., Illinois State Department of Labor
Croxton, Frederick E., Ohio State University
Hurlin, Ralph G., Russell Sage Foundation
Lescohier, Don D., University of Wisconsin
Lorenz, Max O., Interstate Commerce Commission
Patton, Eugene B., New York State Department of Labor
Phelps, Roswell F., Massachusetts Department of Labor
Steiner, W. H., formerly of the Federal Reserve Board
Stewart, W. W., Federal Reserve Board
Tryon, Fred G., U. S. Geological Survey
Wolman, Leo, New School for Social Research
Van Kleeck, Mary, Chairman, Russell Sage Foundation

The Chairman has held sectional meetings with members of the Committee in Madison, Wis., Chicago, Boston, and Washington, D. C., and two general meetings have been held in New York, in May with eleven members present, and in October with ten members present.

The Committee has coöperated with the Committee on the Business Cycle, which was appointed by Mr. Hoover following the President's Conference on Unemployment. The section on employment statistics of the report on the business cycle was written by the Chairman of the Committee on Employment Statistics, with the advice and assistance of the other members.

The full report of the year's work was presented by the Chairman at the session following the business meeting of the Association, the program of which had been prepared by this Committee. The topics discussed related directly to the work of the Committee, and a graphic exhibit was prepared under its supervision and was shown at the meeting to emphasize the relations of employment data to other economic facts. The state and federal departments of labor had been invited to send representatives, and the consumers of employment statistics were representated in the discussion. This closing session brought together a representative group of experts for the discussion of the facts of employment, one of the most important statistical and economic problems of the day.

Committee on Membership

The Chairman, Edwin W. Kopf, Assistant Statistician of the Metropolitan Life Insurance Company, made an oral report concerning the work of his committee during the past year, emphasizing the importance of each member of the Association acting as a volunteer on this committee. Only by such coöperation on the part of individual members of the Association can the numbers be maintained and increased.

Committee on Nominations

The report of the Nominating Committee, consisting of Carroll W. Doten, Chairman, Willford I. King, and G. P. Watkins, was presented for final action.

The Acting Secretary was instructed to cast one ballot for the nominations as presented. The following officers for the year 1923 were declared elected: President, Warren M. Persons; Vice-Presidents, Malcolm C. Rorty, Louis I. Dublin, James W. Glover; Counsellors, W. S. Rossiter, Carl Snyder, Edgar Sydenstricker; Secretary-Treasurer, Robert E. Chaddock; Editor, William F. Ogburn; Librarian, Horace L. Wheeler.

RESOLUTIONS CONCERNING THE PROPOSAL FOR A STANDARD SERIES OF STATISTICAL REFERENCE BOOKS

The Association adopted the following resolutions:

Resolved, that the directors of the American Statistical Association should constitute themselves a general committee for the purpose of considering the preparation, either of a syllabus of training in the elementary and intermediate ranges of statistical methodology, or of a series of statistical reference books covering a similar field.

Resolved Further, that if it shall appear to the satisfaction of this general committee that the preparation of such syllabus or series of reference books can be arranged without cost to the Statistical Association, the said general committee be authorized to take the following further steps:

(a) To appoint an editor-in-chief and special editorial board, this board, except for the editor-in-chief, to be made up of the several writers who undertake to prepare individual texts or sections of the syllabus;

(b) To appoint an advisory board which shall coöperate with the editorial board in the preparation of the required texts or syllabus;

(c) To select a publisher and determine an equitable basis for the apportionment of royalties as between and among the several writers and the editor-in-chief;

(d) To make initial recommendations to the editorial board as to the general scope and plan of the series of reference volumes.

And Resolved Further, that the said general committee be empowered to consult with the Royal Statistical Society of Great Britain and with the leading statistical associations and statistical authorities in other English-speaking countries to the end that without delaying the preparation of the desired reference books or syllabus for use in the United States, the possibility may be left open for the ultimate preparation of a similar syllabus or series of reference books representing the consensus of experience and opinion among English-speaking statisticians.

Appropriate resolutions of appreciation of the work of the Directors, the Editor and his associates, and the Secretary-Treasurer in directing the affairs of the Association during the past year were adopted.

EDWIN W. KOPF, *Acting Secretary*
ROBERT E. CHADDOCK, *Secretary*

CORRESPONDENCE

To the Editor of the Journal of the American Statistical Association—

Sir: Dr. Arne Fisher has called my attention to a regrettable error in the equations at the foot of page 212 in my article on "The Determination of Secular Trend," in the JOURNAL for June, 1922. These equations should read:

$$\frac{\partial \lambda_i}{\partial m} = -\frac{x_i}{m^2(i+T)}, \quad \frac{\partial \lambda_i}{\partial T} = -\frac{x_i}{m(i+T)^2},$$

and corresponding changes must be made in equation (8). I have examined the error carefully, and find that it was one of transcription; and that the rest of the analysis, as given in equations (9), (10), and (11), is correct and follows from the correct form of equation (8). However inexcusable the slip, it does not therefore render invalid the remainder of the solution.

I should like to acknowledge also at this time the valuable suggestions on the subject which were presented in Professor Working's criticism in the issue of December, 1922. His comment on the effect of curvature, on page 501, is especially interesting; and I shall hope shortly to make a further study of this phase of the problem.

Yours truly,

W. L. CRUM

To the Editor of the Journal of the American Statistical Association—

Sir: Most persons occupied with the study of statistics are doubtless aware of the opportunities for research in that field which are presented in the city of Washington, and of the advantages which a period of residence there affords to both older and younger students; yet it is likely that not all of these opportunities and advantages are adequately known. Those who enjoy them by reason of professional residence are strongly desirous that they should be better known and more largely used. The collections of the Library of Congress and of the many departments and bureaus which stand in some relation to our study, and especially their records and unprinted materials, offer advantages that cannot be duplicated elsewhere. Great benefit may be derived from the opportunity for direct contact with the statistical work of the Bureaus of the Census, Foreign and Domestic Commerce, Labor Statistics, Education, Internal Revenue, Markets and Crop Estimates, Farm Management and Farm Economics, the Interstate Commerce Commission, and other government bureaus or offices, while such institutions or organizations in Washington as the Institute of Economic Research, the United States Chamber of Commerce, the Bureau of Railway Economics, and the Carnegie Institution, all of which are disposed to be helpful to students, add signally to the opportunities afforded by the government establishments in making the capitol one of the most important centers in the United States for work in statistics and other social studies. In several of these governmental and endowed establishments special pains are taken to serve the interests of students by lectures, courses of informal instruction, or practical training through participation in the work of the respective offices.

In order that students may be encouraged and aided in availing themselves of these opportunities, in the fields of history, political science, economics and statistics, and international law and diplomacy, a voluntary association of some thirty scholars occupied with these studies has instituted the University Center for Research in Washington, organized in a self-governed body styled "The Board of Research Advisers." The Director of the American Council on Education has served as its secretary, and has maintained for it a place of registration for students. Its Committee on Management has consisted during the past year of Dr. Leo S. Rowe, Director General of the Pan-American Union (President of the Board of Research Advisers), Dr. Samuel P. Capen, Director hitherto of the American Council on Education, Dr. J. Franklin Jameson, Director of the Department of Historical Research in the Carnegie Institution of Washington, Dr. Vernon Kellogg, Executive Secretary of the National Research Council, and Mr. William F. Willoughby, Director of the Institute of Government Research. The members of the Division of Statistics have been Dr. Julius Klein, Director of the Bureau of Foreign and Domestic Commerce, Dr. Max Lorenz, Director of Statistics, Interstate Commerce Commission, Mr. Lewis Meriam, Statistician, Institute of Government Research, and myself. All have been ready to be helpful in all possible ways to students coming to Washington for the pursuit of investigations in our field, and the machinery of the center makes it possible to bring each student into connection with the persons in Washington who will be most useful to him, to direct him to the materials he will need, to give some helpful supervision to his investigations, and to report upon his progress to the university professors or authorities from which he is accredited.

The members of the Board of Research Advisers are very desirous that its proposals, intentions, and means of help may be extensively known in the appropriate academic circles. Those belonging to the Division of Statistics, of which I am Chairman, earnestly request you to bring this matter to the attention of the members of the Statistical Association.

Very truly yours,

JOSEPH A. HILL,
Assistant Director of the Census

MISCELLANEOUS NOTES

The Statistical Reference Series. The round table discussion of "Standards of Training and Practice in Statistics" at the Chicago meeting of the Statistical Association resulted in the unanimous approval of a resolution recommending that the directors of the Association constitute themselves a general committee to consider further the plan for a series of statistical reference books which was outlined in the December issue of the JOURNAL. This action was confirmed at the business meeting of the Association, and the directors were authorized, at their discretion, to take the necessary steps to secure the preparation and publication of the series.

The discussion was well attended, and the various papers and informal comments have furnished an exceedingly valuable background for further action. Differences of opinion as to matters of statistical technique and as to the relative attention which should be given to various elements of statistical method were numerous. Considerable emphasis was put upon the magnitude of the undertaking, and the feeling was rather generally expressed that the groundwork for the reference series must be very carefully laid and that the series as a whole could not be completed in less than two or three years' time. Nevertheless, both the practicing and the academic statisticians present were almost, if not wholly, unanimous in their opinion that the work should be undertaken and should be pushed forward as rapidly as possible.

It is expected that a fuller report to the membership of the Association will be made in the June issue of the JOURNAL.

Census Data Relating to Coal Miners. The Bureau of the Census, in coöperation with the Coal Commission, has been making a tentative tabulation of limited scope relative to miners and their families in the coal districts, the basic data being derived from the 1920 population schedules and tabulated by use of a punch card. The tabulation included one group of about 9,000 miners in Belmont County, Ohio, and another of equal size in Westmoreland County, Pennsylvania.

The miners were classified as native and foreign, and the foreign were further classified in twelve nationality classes. They were then tabulated with respect to the number of years in the United States, citizenship (whether naturalized or alien), illiteracy, inability to speak English, age, marital condition, whether maintaining a home or boarding or lodging, whether owning homes or renting, and whether home if owned is mortgaged. Those miners maintaining homes were further tabulated with respect to the number of members in the family, the number of members working for money, the number of children in school, at home, and at work, cases in which the wife was working for money, cases in which the family took boarders or lodgers, with a further classification according to the number of boarders or lodgers.

The tabulation was in some degree experimental, being undertaken with a view to determining first of all how much information of value for the inquiry of the Coal Commission could be derived from the population census schedules relating to mining communities. The results of the experiment have removed all doubts. The great value of a tabulation of this kind was immediately apparent and was fully recognized by the Coal Commission. Dr. Charles P. Niell does not hesitate to say that this work, if it can be continued, as is hoped, so as to cover practically all coal mining fields, will constitute one of the most valuable social-economic surveys ever made in this country. Thus, it furnishes another illustration of a fact which is not perhaps generally known and appreciated, namely, that the data obtained through the population census have been only partly exploited when the Census Bureau completes the comprehensive standard classifications which are contained in the decennial census reports.

J. A. H.

Creation of the Institut de Statistique at the University of Paris. An Institute of Statistics was created by a decree on July 31, 1920. It is to be under the scientific direction of the Faculties of Law, Sciences, and Medicine of the University of Paris. Its object is to give instruction in statistical method and its application. The courses will have both a theoretical and a practical character, and will include conferences and practical exercises.

The Institute holds its seat in the Faculty of Law. It is administered by a council of twenty-five members, including the deans of the respective faculties, representatives of the Institut de France, the Statistique générale de la France, the Societé de Statistique, the Societé d'Economie Politique, the Chambre de Commerce de Paris, and professors from interested faculties. It is presided over by the rector of the University of Paris, and a directing committee of seven members has been constituted. The council of administration has appointed as vice president to preside over the committee of direction M. Clement Colson, member of the Institut de France, president of the Council of State section, professor of Political Economy in the different schools of the university.

Besides the preparatory studies relating to method, the courses, conferences, and practical work are divided into five groups:

1. Demography, biometry, hygiene, and public health
2. Insurance and actuarial science
3. Industry, agriculture, and commerce
4. Transportation and institutions of credit
5. Public finance

A diploma is given, at the conclusion of the studies, to all students who have satisfied the conditions.

L. M.

Regional Planning for New York and Its Environs. The committee appointed by the Russell Sage Foundation to start the development of a regional plan of New York and its environs has now in hand preliminary reports on which to base its detailed studies.

An economic and industrial inquiry, which is primarily an attempt to discover the proper relations of activities to regions, has been outlined by Mr. Walter W. Stewart, of the Federal Reserve Board, and Professor Roswell C. McCrea, of Columbia University.

The inquiry into social and living conditions has been divided into four fields—health, housing, school facilities, and recreation. Dr. Haven Emerson, of Columbia University, has summarized the considerations of health and medical care which will affect regional planning. In a preliminary study of housing, Mr. Lawson Purdy, formerly tax commissioner of New York, and Mr. Wayne D. Heydecker, of the American City Bureau, have checked and compiled already existing data on housing and construction. Dr. George D. Strayer and Dr. N. L. Engelhardt, of Teachers College, have made suggestions concerning school buildings and administrative units. Mr. Lee F. Hanmer and Mr. C. A. Perry, of the Russell Sage Foundation, have listed the questions which must be solved before the problem of recreation can be adequately covered.

The physical survey has been in the charge of Mr. Nelson P. Lewis, formerly chief engineer of the Board of Estimate and Apportionment. The survey has completed a large portion of its inventory of the physical assets and liabilities of the regions, and many maps and drawings have been prepared.

The legal survey covers a wide and important field. Much of the work has been completed, but several studies are still in progress.

Volume of Employment Data. The United States Bureau of Labor Statistics in its volume of employment report, issued in January and covering data as of the 15th of December, 1922, covers 43 manufacturing industries, 3,294 establishments, and over one and a half million employees. The Bureau for the first time tabulated in the December issue of the *Monthly Labor Review* the volume of employment and payroll data for the railroads, giving 7 of the 8 subdivisions as carried by the Interstate Commerce Commission. The plan of the Bureau has been to give the totals for these subdivisions, then to segregate in each division a few of the principal occupational groups believed to convey the most adequate idea as to the real increase or decrease in the volume of railroad employment in the several departments of railroad work.

The percentage of full time production in bituminous coal mines, the publication of which was suspended by the Bureau of Labor Statistics during the strike, is again presented.

Labor Legislation in Mexico. The United States Bureau of Labor Statistics is making a special drive to secure labor legislation now in effect in the various Mexican and South American States. An article in the December issue of the *Monthly Labor Review* analyzes the laws recently enacted by 7 of the 27 Mexican States, and also the laws passed by the national congress for the Federal District and the territories. Most of the Mexican States have begun to legislate more or less in conformity with the requirements of Article 123 of the national constitution. It will be interesting to watch the variations in this legislation from state to state, and the different constructions that are apparently being put upon the requirements of Article 123.

Investigations of the U. S. Bureau of Labor Statistics. The efficiency and productivity of labor in sawmills are analyzed in some detail in an article on that subject by Commissioner Ethelbert Stewart of the United States Bureau of Labor Statistics in the January issue of the *Monthly Labor Review.* This subject of labor productivity or the time cost per unit of the various industries is a phase of the labor question to be given considerably more emphasis by the Bureau now than formerly.

An investigation into brick making, while dealing basicly with wages and hours, will show by processes labor cost and time cost per thousand brick. In the current investigation of wages and hours of labor in the iron and steel industry this question of productivity is being emphasized for the first time. The field work of an investigation of wages and hours of labor in the automobile industry has been practically completed.

A University Statistical Service. A London and Cambridge Economic Service under the auspices of the London School of Economics and Political Science and of the Economics Department of the University of Cambridge has now been established. This Service will work in coöperation with Harvard University and will correspond to the Harvard Service already established in the United States. Within the last twelve months the London School of Economics and Political Science (University of London) has set on foot a systematic study of statistics and memoranda bearing on current trade conditions in Great Britain. Some of the results of this investigation have been published in the *Reconstruction Supplements* of the *Manchester Guardian*, under the title, "A Barometer of Economic Conditions."

The Chicago Meeting. The meetings of the American Statistical Association at Chicago proved unusually successful in spite of the fact that Secretary Chaddock was detained by illness in his family.

The first meeting was held jointly with the American Economic Association. Mr. Malcolm C. Rorty, a vice-president of this Association, presided. The attendance was about eight hundred, presaging unusually full meetings for all the associations which had gathered at Chicago. In the evening the Statistical, Economic, and Sociological Associations met to listen to presidential addresses. The audience at that meeting must have numbered a thousand.

Thursday's program proved extremely successful. The morning session, devoted to population problems, developed noteworthy papers and discussion before an audience that packed the meeting room. The afternoon was devoted to a round table discussion of practical problems of statistical method and the value and need for textbooks, and again the meeting room was crowded to the doors. So interesting was this conference that it did not conclude until nearly six o'clock.

Friday morning brought the annual business meeting, followed by a joint meeting with the American Association for Labor Legislation. Again a large audience was present.

The Chicago gathering demonstrates that the American Statistical Association can prove of increasing importance to its members if they will aid in the preparation of interesting and helpful programs for the annual meetings and make the meetings of real value by their presence.

W. S. R.

British Conference on Statistics. Among the projects under discussion in connection with the British Empire Exhibition to be held in London in 1924 is a British Empire Conference on Statistics, to proceed further with the proposals discussed at the similar conference of 1920.

Canadian Employment Statistics. The employment statistics of Canada, based on reports from employers, which previously have been collected by the Department of Labour, Canada, will in future be collected by the Dominion

Bureau of Statistics but will continue to appear in the *Labour Gazette*, though the preliminary and summary figures will be given to the press monthly by the Bureau.

The University Journal of Business. From the School of Commerce and Administration of the University of Chicago there comes the first number of a new journal, the *University Journal of Business*, which will be issued in coöperation with other collegiate schools of business. Its object is to stimulate intellectual activity and coöperation among business school students and to develop a closer and more helpful relationship between business education and the world of practical affairs.

Metric Standardization. A Conference on World Metric Standardization was held at Pittsburgh last September to consider the best methods of furthering the general adoption of the metric system. The Conference went on record as of the unanimous opinion that the gradual adoption of the metric system was desirable and practicable, and it voted to take steps which might eventually bring about such adoption.

Massachusetts Industrial Charts. In response to the petition of George W. Coleman, of the Babson Institute, and others that the Massachusetts Commission on Foreign and Domestic Commerce be authorized to furnish to newspapers charts of the chief industries of the Commonwealth, a bill was introduced into the Massachusetts Legislature providing for the publication of such charts in January and July of each year. The charts are to include all the chief industries of the Commonwealth and are to show the relative growth of production, sales, prices, and earnings as compared with general business as shown by the Babson chart of business conditions.

Immigration and Naturalization Data. Dr. Harry H. Laughlin, assistant director of the Eugenics Record Office, Cold Spring Harbor, Long Island, has recently completed an extensive statistical study of the relative adequacy of the various immigrant races in the United States for the Committee on Immigration and Naturalization of the House of Representatives. The report of the investigation will be published by the Committee.

Unemployment Relief Data. Dr. Philip Klein has been engaged in a study for the Russell Sage Foundation of unemployment relief activities in fifteen American cities during the emergency winter of 1921–22. The report of his investigation, under the title *The Burden of Unemployment*, is now in press.

A New Committee on Immigration. Under the auspices of the National Research Council a committee has been formed for the purpose of coördinating and developing plans for the scientific study of immigration. The committee consists of Miss Mary Van Kleeck, of the Russell Sage Foundation, chairman; Professor Fred R. Fairchild, of Yale University, from the Economic Association;

Professor Howard Lee McBane, of Columbia University, from the Political Science Association; and Professor William F. Ogburn, of Columbia University, from the American Sociological Society and the American Statistical Association.

Dr. Royal Meeker, of the International Labor Office under the League of Nations and editor of the *International Labor Review*, is in this country for a short time, attending to matters connected with his duties abroad.

Upon the recommendation of the Surgeon General of the Public Health Service, Secretary of the Treasury A. W. Mellon has granted leave of absence for one year (beginning January 20, 1923) to Mr. Edgar Sydenstricker, statistician in charge of the Statistical Office of the U. S. Public Health Service, that he may accept an appointment in the Secretariat of the League of Nations as chief of the Epidemiological Service and Public Health Statistics of that organization. The new Epidemiological Service was made possible by a grant of money from the International Health Board for a period of five years. Mr. Sydenstricker's work during the first year will be along the lines of establishing international exchange of epidemiological and statistical information relating to public health.

Miss Dorothy Wiehl, junior statistician in the Public Health Service, has joined the Secretariat as an assistant to Mr. Sydenstricker.

Mr. Kenneth M. Gould, formerly associate editor of the *American Journal of Public Health*, has severed his connection with the American Public Health Association and the American Social Hygiene Association to become editor of publications for the Rockefeller Foundation.

The *Journal of Public Health* will be edited in the future by Dr. Henry F. Vaughan, commissioner of health, Detroit, Michigan, assisted by an editorial board composed of Dr. M. P. Ravenel, of the University of Missouri, and Mr. A. W. Hedrich, secretary of the Association.

Dr. Bryce M. Stewart, who for some years has been director of the Employment Service of the Department of Labor of Canada, has accepted a position with the Chicago Joint Board of the Amalgamated Clothing Workers of America. Dr. Stewart will have charge of the organization's employment service which is being instituted at Chicago. At the time of his retirement, Dr. Stewart had held for two years the position of president of the International Association of Public Employment Services.

Professor James W. Glover, of the University of Michigan, was the De Lamar lecturer at the Johns Hopkins University on February 19. His subject was "Life Tables as Applied to Public Health." Professor Glover prepared the United States Life Tables, 1890, 1901, 1910, and 1901–10, recently issued by the Bureau of the Census.

Mr. Milan V. Ayres has given up the editorship of *Index*, the weekly statistical bulletin of the Associated General Contractors of America, with offices in Washington, and is now connected with the Armstrong Bureau of Related Industries of Chicago.

MEMBERS ELECTED SINCE NOVEMBER

Adams, V. G., Burnside Shops, Illinois Central R. R., Chicago, Ill.
Baker, Oliver E., Bureau of Agricultural Economics, Washington, D. C.
Bird, F. H., United Typothetae of America, Chicago, Ill.
Bjorka, Knute, Iowa State College, Ames, Iowa
Brand, E. A., Tanners' Council, 41 Park Row, New York City
Brookings, Robert S., President, Institute of Economics, Washington, D. C.
Chandler, H. A. E., National Bank of Commerce, New York City
Cherington, Paul T., J. Walter Thompson Co., New York City
Cover, John B., Dept. of Economics, Columbia University, New York City
Coxe, Warren W., Bureau of Educational Research, Ohio State Univ., Columbus, Ohio
Crocker, Stuart M., Ass't Secretary, General Electric Co., New York City
Davenport, Donald H., Columbia University, School of Business, New York City
Davis, William L., Wellesley College, Wellesley, Mass.
Dickinson, Helena M., Committee on Social and Religious Surveys, New York City
Dodd, Alvin E., Manager, Domestic Distribution Dept., U. S. Chamber of Commerce, Washington, D. C.
Du Brul, Ernest F., General Manager, Nat'l Machine Tool Builders Ass'n, Cincinnati, Ohio
Duffield, Thomas J., School of Public Health, Harvard Medical School, Boston, Mass.
Ebersole, J. F., Federal Reserve Bank, Minneapolis, Minn.
Falk, A. T., Gordon Van Tine Co., Davenport, Iowa
Fitch, W. E., Vice-President, Laundry Owners National Ass'n, LaSalle, Ill.
Hanley, N. F., General Electric Co., Pittsfield, Mass.
Heim, William L., Wood Chemicals, Kane, Pa.
Holt, Byron H., Goodbody & Co., 115 Broadway, New York City
Hughes, P., Southern Pacific Co., 65 Market St., San Francisco, Calif.
Huston, Frank M., Federal Reserve Bank, Chicago, Ill.
Irish, H. E., Western Electric Co., New York City
Jerome, Harry, Dept. of Economics, University of Wisconsin, Madison, Wis.
King, E. D., Magazine of Wall St., 42 Broadway, New York City
Lincoln, E. E., Western Electric Co., New York City
Little, Roscoe E., Secretary, International Milk Dealers, Chicago, Ill.
Lombard, J. P., Bronxville, N. Y.
Lower, Walker W., Secretary Nat'l Ass'n, Sheet and Tin Plate Mgfrs., Pittsburgh, Pa.
Luckhurst, Harry, Amalgamated Engineering Union, London, England
Mackentosh, William A., Queens University, Kingston, Canada
Malzberg, Benjamin, State Board of Charities, Albany, N. Y.
Marget, A. W., Student with Professor Persons, Harvard University, Cambridge, Mass.
Marshall, P. M., Purchase Engineer, Western Electric Co., New York City

May, Stacy, Dept. of Economics, Brookwood Workers' College, Katonah, N. Y.
Mead, Franklin B., Lincoln National Life Ins. Co., Fort Wayne, Ind.
Moffat, Mrs. Adeline M., Student at Columbia University, New York City
Montgomery, Robert H., Columbia University, New York City
Moore, Justin H., Irving National Bank, New York City
Moore, O. L., Secretary, Sales Book Mfrs. Ass'n, Chicago, Ill.
Morgan, P. W., Federal Reserve Bank, Kansas City, Mo.
Murchison, C. T., University of North Carolina, Chapel Hill, N. C.
Paine, G. H., Domestic Distribution Dept., U. S. Chamber of Commerce, Washington, D. C.
Patterson, L. S., Brooklyn Edison Co., Brooklyn, N. Y.
Patton, F. L., Clinton, New York
Reynolds, E. G., Tide Water Oil Co., 11 Broadway, New York City
Robinson, A. H., Eastman Kodak Co., Rochester, N. Y.
Root, W. T., University of Pittsburgh, Pittsburgh, Pa.
Schmalz, Carl N., The Rike-Kumler Co., Dayton, Ohio
Shackleton, A. M., New York Telephone Co., New York City
Smith, G. H., Westinghouse Air Brake Co., Pittsburgh, Pa.
Starbuck, William D. L., Consulting Engineer, 4 W. 43d St., New York City
Stewart, Charles L., Bureau of Agricultural Economics, Washington, D. C.
Tapley, Gilbert H., Amos Tuck School, Dartmouth College, Hanover, N. H.
Taylor, C. E., Security Trust & Savings Bank, Los Angeles, Calif.
Toops, Herbert A., Teachers College, Columbia University, New York City
Van Kirk, Jay C., Dept. of Accounting, Tulane University, New Orleans, La.
Walker, Francis W., Secretary, Association of Tile Mfrs., Beaver Falls, Pa.
White, Charles R., Research in production of paper and paper board, 1440 G. St., Washington, D. C.
Whitney, Nathaniel R., University of Cincinnati, Dept. of Finance, Cincinnati, Ohio
Willey, Malcolm M., Student at Columbia University, New York City
Wilson, Edwin B., Dept. of Vital Statistics, Harvard School of Public Health, Boston, Mass.
Worfolk, Frederic, Accountant, 9 E. 46th St., New York City
Younker, Ira M., Franklin Simon Co., New York City

REVIEWS

A Treatise on Probability, by J. M. Keynes. London: Macmillan & Co. 1921. xi, 466 pp.

In preparing a review of a book of this sort it is possible to proceed from one or more of several points of view. Among these we may mention four of perhaps chief importance. The reviewer may make a detailed criticism of mathematical and other arguments of the work, with the intent of revealing more or less important slips in the reasoning. He may examine whether the author who uses the pretentious title "treatise" has presented a sufficiently comprehensive discussion of the subject, whether indeed there is any evidence that the author lacks knowledge of or gives too little weight to important phases of the general topic. He may take up for criticism some of the general conclusions or the new hypotheses suggested by the author, and seek to establish their validity or to find their further consequences. It is possible also to be content with a summarization of the author's leading views and results and an exposition of the book's practical usefulness and appeal to the reader. For the benefit of readers who know what they seek in a review and care for nothing else, it may be said that most of the following comment is written for the last of these purposes.

The *Treatise* gives a much broader interpretation to the term "probability" than the reader who is accustomed to the classical theory generally adopts. The author contends that the accepted doctrine of probability is exceedingly narrow, chiefly because its mathematical development presupposes that every probability is capable of representation numerically; and he is at great pains to show that the actual probabilities of practical importance are ordinarily not properly represented by numbers. He contends, indeed, that we can in most cases locate a probability only in a series of probabilities arranged in the order of magnitude, that there are many such series, and that it is ordinarily impossible to state whether a probability in one series is greater or less than a probability in another series. In developing this idea, and indeed throughout the work, the author insists that a probability is in truth a relative magnitude. To emphasise this fact, and to facilitate clearer thinking, he introduces and gives continued prominence to his symbol a/h for the probability of a conclusion a derived from premises h.

Much of the author's attention is given to criticism of existing ideas on probability and to the surrounding of the classical hypotheses with certain restrictions which are designed to remove the objections occasioned by the many paradoxical conclusions of the older theories. One of the first concepts to be attacked is the Principle of Non-Sufficient Reason. He gives it a new name, the Principle of Indifference, and proceeds to expose the inadequacy of the principle by itself. He points out that its proper use involves always a direct judgment of relevance: it can be used only when we decide that the

existing evidence does not favor the one proposition over the other. He contends, at various stages of his work, that the application of the Principle of Indifference in instances where relevant information does favor one of the alternatives is a leading cause of error in the traditional theory. He stresses the part that direct judgment must play in every case: it must always enter in the determination of the equality or inequality of the probabilities; but he urges that this difficulty is not a serious obstacle to the use of his theory.

He outlines the development and presents the tenets of the frequency theory of probability and maintains that this theory as generally accepted is unsound, chiefly because it sidesteps the issue by defining a new quantity—the statistical frequency—as probability. He suggests that the originators of this theory themselves stated that a large number of questions of probability must be excluded, or rather that such questions were not problems in probability at all from their point of view. The author maintains that his theory is the generalized theory, and he includes as special cases, in addition to the many cases of probability not explicable on the frequency theory, the cases for which the frequency method is valid.

With Chapter IX the author concludes his Part I, in which he has undertaken to set forth the "fundamental ideas" which serve as the basis for his theory. The next part is devoted to the development of the theorems which constitute the framework of his doctrine. Concerning this section of the book he remarks: "I am not certain of how much positive value this Part will prove to the reader," and "it is a part of the spade-work which the conscientious author has to undertake; though the process of doing it may be of greater value to him than to the reader. . . . " Indeed, the reader may successfully study the book and omit these chapters, but the reviewer feels that he will have missed much of value. Many who glance through the treatise will be frightened away by the forbidding symbolism which has a large place in this part; but it should be urged that the reader who skips the symbolic argument can yet follow most of the reasoning in its verbal restatement and need not lose sight of any of the important conclusions. It is suggested, however, that the effort required to master the significance of the symbols will be well repaid, for it is apparent that the author has set up a powerful system of logical reasoning. One realizes, in going through Chapters XIII and XIV, that the symbolic treatment enables the author to start out from a few carefully defined concepts and proceed directly and rapidly to many important conclusions by the use of devices which keep constantly before him the essential features of the initial assumptions and definitions. The reviewer believes that the methods which the author uses in this part will, without coming into general use, constitute an important part of the analytical equipment of statistical theorists.

For the practical statistician the most interesting chapter in this part is Chapter XVII, where the author develops certain theories on the nature of averages and pays particular attention to several laws of error. He stresses the general inadequacy and inappropriateness of the arithmetic average and suggests that the simplicity of calculation of this mean has been one of its chief recommendations. "It is always easier to add than to multiply," he remarks.

On page 211 he examines the problem of weighting an average, and insists that there are many cases when it is logically essential to give different weights to the several observations. He objects to the fallacious doctrine which has gained wide acceptance that weighting is largely a matter of indifference. In winding up a chapter which the statistical worker might well wish to see greatly amplified, he gives a brief treatment of the question of rejection of observations. It is to be hoped that the discussions outlined in Chapter XVII will be taken up and developed much more fully, for applied statistics waits upon a more thorough critical examination of its fundamental methods than any we now have.

Part III is an exposition of the important logical background of the author's theory under the title "Induction and Analogy." He defines his terms as follows: "We argue from Analogy in so far as we depend upon the *likeness* of" the observations "and from Pure Induction when we trust the *number* of the experiments." He insists that the number of the experiments is valuable only because the Negative Analogy is strengthened thereby, *e. g.*, the experiments possibly increase the variety amongst those characteristics of the instances which are not essential to the generalization.

It is in Chapter XX of this part that the author brings out the possibility of giving an approximate numerical expression to non-numerical probabilities. "There is one class of probabilities, however, which I called the numerical class, the ratio of each of whose members to certainty can be expressed by some number less than unity; and we can sometimes compare a non-numerical probability in respect of more and less with one of these numerical probabilities."

His chief thesis in this part is that the methods of pure induction are valid only in the support of a proposition for which there exists some *a priori* finite probability. This *a priori* probability will in general arise from considerations of analogy. The bearing upon statistical applications of this conclusion is obvious. If we grant this fundamental proposition of Keynes, we must recognize openly the fact, which is doubtless often tacitly assumed, that we use statistical arguments solely to strengthen propositions for which there already exists a degree of probability. To use his own words relative to a particular instance: "The truth is that sensible investigators only employ the correlation coefficient to test or confirm conclusions at which they have arrived on other grounds." He adds: "But that does not validate the crude way in which the argument is sometimes presented, or prevent it from misleading the unwary—since not all investigators are sensible."

Part IV is perhaps the least interesting to the practical statistician, but he who reads it will find his thought quickened by many suggestive passages. Perhaps attention should be called to the discussion at the close of Chapter XXV which leads up to the statement: "The opposite view, which the unreliability of some statisticians has brought into existence—that it is a positive advantage to approach statistical evidence *without* preconceptions based on general grounds, because the temptation to "cook" the evidence will prove otherwise to be irresistible—has no *logical* basis and need only be considered when the impartiality of the investigator is in doubt."

It is in Part V, "The Nature of Statistical Inference," that the statistician

will find most of direct interest. The reviewer would gladly go much more into detail in the discussion of this part than of the earlier sections of the book, but he trusts that the readers of the JOURNAL will examine these pages for themselves, and he assures them that they will find a mine of stimulating suggestions relative to methods which are in general use in statistical work. The author commences his treatment with an insistence upon the two distinct functions of statistical theory, the descriptive and the inductive. It is with the second function, and its limitations, that he is primarily concerned. He urges that as the technical means of description become more complicated, the tendency to pass over from description to induction with undue regard for the assumptions involved rapidly increases. "The truth is obvious; yet, not unnaturally, the more complicated and technical the preliminary statistical investigations become, the more prone inquirers are to mistake the statistical description for an inductive generalization."

Much of the earlier section of Part V is devoted to a study of the Law of Great Numbers. This he designates the "Stability of Statistical Frequencies"—indeed, there are several places in the book where the author introduces new names for old concepts, and his suggested changes generally aim to enunciate a little more precisely the actual idea involved. An instance of a similar restatement without change in name will be found in his remark that the Law of the Uniformity of Nature is an assertion of the irrelevance of mere position in time and space to certain generalizations of science. His general survey of the Bernoulli Theorem and the Rule of Succession will undoubtedly provoke much comment and further study; but the essence of his case, that our knowledge of the fact of past occurrences alters or may alter the probability of the next occurrence, will scarcely be contested. "Yet it is this type, where there is a change in knowledge but *no change in the material conditions* from one instance to the next, which is most frequently overlooked." In these words he calls attention to one of the most insidious sources of error in statistical reasoning; and many applied statisticians will find it easy to cite illustrations from their own experiences.

The latter half of Part V is given over almost entirely to criticism of statistical practice. "Generally speaking, therefore, I think that the business of statistical technique ought to be regarded as strictly limited to preparing the numerical aspects of our material in an intelligible form, so as to be ready for the application of the usual inductive methods." It is generally not valid to proceed also, by statistical technique, to calculate probabilities. Enough has perhaps been said to show the reader that the author calls in question the validity of much of the current generalization based upon statistical arguments. The statistician can hardly find a short cut to an understanding of the author's contentions and to a realization of their wide significance in practical work: let him rather turn to these chapters and read them sympathetically and with a resolve to grasp their true bearing upon his own problems.

In bringing these comments to a close, the reviewer wishes to state deliberately that this is the most stimulating book on the fundamentals of statistical theory that he has read in many months. It has already been suggested that the practical statistician will well afford a thorough study of the book and its

criticisms and constructive suggestions for the applications of statistics. For the theorist, one reading of the book will hardly suffice. Successive readings, with increasing attention upon the details of analysis and conclusion, will open up for him many avenues for further research. At many points in the book the author hints at unsolved difficulties, and not the least of these problems which he passes on to others is the extension of his theory of statistical inference: "I believe that the foregoing analysis is along the right lines and that it carries the inquiry a good deal further than it has been carried hitherto. But it is not conclusive, and I must leave to others its more exact elucidation."

W. L. C.

Insurance Against Unemployment with Special Reference to British and American Conditions, by Joseph L. Cohen. London: P. S. King & Son, Ltd. 1921. 536 pp.

The main body of the book is divided into four parts: Part I (covering 75 pages) is entitled "The Problem of Unemployment Insurance"; Part II (84 pages), "The Ghent System of Unemployment Insurance"; Part III (232 pages), the major portion of the book, "The British System of Unemployment Insurance"; Part IV (104 pages), "The Unemployment Problem in the United States." Details of special schemes and problems in connection with the British system are given in appendices I–IV. The appendices are followed by a list of books and papers used.

Mr. Cohen has assembled a quantity of material bearing on the problems of unemployment and insurance against unemployment in the more important industrial countries. The material is not well chosen; its analysis leaves much to be desired; and it is very poorly organized. In fact, the most outstanding fault of the book is its lack of organization. Given poorly selected and incomplete material, there can be no justification for its presentation in disjointed and disorganized form. It is apparent that Mr. Cohen has gathered his material from many sources and over a considerable period of time. The conclusion is forced that publication was too hasty or that the trees obscured the forest. The greater part of the book reads like hastily assembled notes. But little less objectionable is the tendency to indulge in loose statements or broad generalizations. In discussing the theory of unemployment and particularly in the application of theory the author appears to be uncertain and confused.

In many instances the author has failed to make use of recent available material. As an example, statistics for France do not go beyond 1912 for the most part; for Switzerland, 1912; for Denmark, 1914; for Germany, 1912; for Italy, 1914. Even in the detailed analysis of the British system the author has been content frequently with statistics of 1912 and 1913 vintage. True, an attempt has been made to show recent developments in legislation, but an analysis of the British scheme, at least, should make use of more recent material. The only excuse for stopping short of later material in the analysis of the British scheme is the thoroughgoing analysis by Mr. Beveridge published in July, 1913; but Mr. Cohen states (footnote, page 173) that it has been made possible for

him to present information dealing with the administration of the scheme to date.

In discussing administrative problems the author has neglected a fund of material in the decisions of the umpire which show clearly the types of claims and the disposition made. These decisions numbered over 4,000 in November, 1919, but casual reference only is made to them.

It is to be doubted whether Mr. Cohen attaches enough importance to the pressure brought to bear on the British government to extend the insurance in 1916 and to further extend it in the out-of-work donation scheme of 1919 and in the amended act of 1920. Very little is said, in fact, of the out-of-work donation plan, though it is of considerable interest in the development of unemployment insurance in Great Britain. Mr. Cohen would have us believe that the satisfactory demonstration of the possibilities of the employment exchange—a fact not admitted in 1911—was the cause of the "cataclysmic" introduction of the scheme of unemployment insurance in 1911, and that the extension of the scheme followed as a matter of course. His estimate of decasualization schemes (page 202) in conjunction with British unemployment exchanges and insurance overlooks, apparently, the conclusion reached by Mr. Beveridge: "On the whole it cannot be claimed that any substantial progress has yet been made with the decasualization of labor in the principal centers where such labor is employed." (Report on the proceedings of the Board of Trade under the Labour Exchanges Act, 1909, and under Part II of the National Insurance Act, 1911 to July, 1914.) Both Mr. Cohen and Mr. Beveridge were writing of the same industrial centers and of the same period.

Evidences of faulty organization are too apparent to the general reader to call for page references. It may be a matter of opinion whether principles are discussed before, after, or in connection with an analysis of schemes at work, but it would be less confusing if they were not discussed at random. Glaring instances of misplaced discussions and misleading headings are found in Part I in dealing with the problem of unemployment insurance.

The following may be mentioned in passing as instances of loose statements: "The suffering caused by unemployment has been recognized in most European countries, and is beginning to be appreciated in the United States. But its reactions on production have been ignored." (Page 18.) "The paralyzing effects of this insecurity (of employment) lead to results profound and manifold but incapable of economic measurement." (Page 35.) "Not only do we now recognize destitution and unemployment are not due to personal causes, but we know also what remedies to apply to these evils. We can not only diagnose these diseases, but we can prescribe for them. Within five years the average amount of unemployment could be halved, and the suffering resulting from it could be reduced to one-quarter of what it is to-day, if only social legislators had the will and the necessary training for tackling the problem." (Page 40.) "Probably much greater in the aggregate (than relief at public expense) is the amount spent by the fellow workmen and relatives of those who are unemployed." (Page 41.)

Mr. Cohen's definition of unemployment is open to criticism on the same

score: "A workman is unemployed when he is able-bodied, efficient, and, though willing to work in his own trade at the current rates of pay, is unable to find employment because of lack of work." (Page 29.) "Able bodied" and "efficient" are general terms open to various interpretations as evidenced by decisions of the umpire on claims for insurance. Would not inability to find work make for unemployment even though work was to be had? Of course if the clearing of information as to jobs and applicants is complete, "lack of work" may be made a condition of unemployment for employables, but Mr. Cohen's previous analysis does not indicate that his definition was made to fit ideal conditions.

One of the evils of unemployment is said to be the tendency to produce a psychological servility altogether disastrous in a democratic community and particularly dangerous to the healthy development of trade unions. (Page 35.) The effect of unemployment on unions is that it lowers membership, drains funds, and weakens morale, which lessens bargaining power, lowers wages, reduces efficiency, and makes it likely that they (the members) will sell their labor for even less than the employer could afford to pay them. (Page 39.) However, on the same page, Mr. Cohen says: "Unemployment is mainly due to the maladjustment between the price at which labor is demanded and the price at which workmen are willing and able to accept employment." And "During periods when thousands are clamoring for work it would probably prove profitable for many employers to engage more workmen if they could lower the wage level. Unemployment is not due to an excess of labor in general nor to a lack of capital. It is due to the reduction by entrepreneurs of the number of people whom they employ because they cannot employ them all at the rate of profit they desire and at the same time pay the wage demanded by the workmen." Mr. Cohen probably has in mind general wages and prices and profits levels, but he does not carry his analysis to a logical conclusion.

Space will not permit of further discussion. Mr. Cohen's book is of value because of the material assembled. It is to be regretted that better use was not made of the opportunity for a thoroughgoing analysis of existing methods of meeting the problems of unemployment.

B. M. Squires

Chicago, Illinois

Statistics of the Military Effort of the British Empire During the Great War, 1914–1920. The War Office. March, 1922. 880 pp.

The British War Office issued in March, 1922, a report of some 880 pages entitled, "Statistics of the Military Effort of the British Empire During the Great War." It is published by His Majesty's Stationery Office, and the price is 10 shillings and sixpence. It is without doubt the most inclusive compendium of statistical information about the war that has been officially published by any of the participating nations.

In October, 1916, after the war had been in progress for more than two years, Mr. Lloyd George, then Secretary of State for War, arranged for the monthly publication of an Abstract of Military Statistics which brought together in convenient form the more important military data that were currently compiled

by a large number of different branches and offices for use in the control of their administrative operations. The present huge volume has been compiled from these abstracts, and as far as possible the data have been carried back to the outbreak of the war and continued forward to June, 1920, so that they now cover nearly six years of military history.

In the main, the book is made up of detailed tabulations, having in many cases as many as 20 columns of figures, and carried through successive pages so as to include all, or most, of the 70 months covered by the reports. These recapitulations of the original office records are reproduced on so extensive a scale that some 236 pages are devoted to strength reports, about 130 pages to casualties, and nearly 100 to munitions. The book is a veritable mine of information for the historical research student, but despite the high standards of statistical workmanship that are evident in the carefully worded table titles, column headings, and footnotes, the student who uses it will need to be a careful and skilful miner if he is to dig out the facts that he seeks.

The figures of these formal tabulations impressively reflect the immense and far-flung effort of the Empire during the war. The data on casualties cover military losses in six major theaters of operation and in eight minor wars, and the total number of British lives lost in these world-wide conflicts reaches the appalling aggregate of 908,371.

The deadly character of the fighting on the Western Front is shown by the fact that of every nine men sent to France, five were killed, wounded, or captured. The corresponding figures for the Dardanelles campaign show that one fourth of all who served there were battle casualties.

The military efficiency of the German armies is clearly indicated. After the war the British army authorities secured the German records of losses, and these show that during the four years of fighting the British troops lost three men killed, wounded, or captured for every two men lost by the Germans facing them. At the time of the Armistice the ration strength of the Allied combatant forces in France was 6,432,000, as compared with 3,527,000 for the Germans and Austrians.

Among the more unusual sorts of information set forth may be mentioned the sections dealing with war honors and with discipline. The honors bestowed, including medals and citations of all classes, number 256,987. The totals of disciplinary action through courts martial and military courts are even more numerous, reaching a total of 309,511. These last figures do not, however, imply so general a recourse to severity as they seem to, for the total of soldiers sentenced to death as a result of these military trials was less than one per cent, or 3,080, and those executed were scarcely one tenth of those sentenced, a total of 346, of whom 266 paid the penalty for desertion.

Some of the most interesting of the pages present comparative data for the different nations involved. Among the contrasts that these records afford, few are more surprising than the figures giving the numbers of soldiers finally listed as missing by the several armies. For Germany these missing men were 374,000, for England about 168,000, for Belgium 24,000, for Serbia 83,000, and for the American armies only 46 men.

The volume closes with a diary of main events of the war and a descriptive section on the supply services. The diary is a particularly interesting and valuable listing of the day-by-day developments in all the principal theaters of action. To Americans, who customarily think of the war as having been fought in France, it will come as a surprise to note that the column headings of the tabulations of events by principal localities include no fewer than 20 countries in which separate wars were being waged. It also comes as a surprise to find that although the War Diary notes the dates of such important events as the declarations of war by the different nations, and the beginnings and endings of offensives conducted by the different armies, it does not mention the declaration of war by the United States as among the notable happenings, nor does it refer to any battle or action as being conducted by American troops. Nevertheless, the diary is a most valuable compilation, and like the rest of the book, one that is sure to be of inestimable value to soldiers, students, and historians.

LEONARD P. AYRES

Cleveland, Ohio

Unemployment Insurance in Theory and Practice, by the National Industrial Conference Board. Research Report Number 51. New York: The Century Company. 1922. 127 pp.

This study aims to be an "impartial analysis of the facts," and through this "attempts to answer the central question whether social insurance can or should be adopted as a means of meeting the unemployment problem in the United States." As the report of a manufacturers' organization, it is courageous in its admissions as to the prevalence of unemployment, as to the possibilities of reduction through better industrial management, and the past neglect of unemployment prevention. However, the answer of the Board to its central question is opposition to unemployment insurance through legislation but encouragement of employers' unemployment funds.

It is as a report of an employers' association rather than as a fresh contribution to the literature of unemployment insurance that the study is significant. There is nothing essentially new in the approach to the facts nor in the content of the theoretical exposition. While the facts are presented with a commendable absence of bias, the theoretical statement, naturally enough, reflects the manufacturers' point of view.

The outstanding facts concerning voluntary unemployment insurance, voluntary subsidized and obligatory insurance, are presented in convenient form and carefully documented. The value of the presentation, as a whole, is limited, however, by the fact that the material is largely based upon secondary sources. While the data thus garnered are usually up to date, notably so in the presentation of British unemployment insurance and of unemployment insurance plans of American employers, it is unfortunate that the statement of the Ghent system should have been based almost wholly on the Twenty-fourth Annual Report of the United States Commissioner of Labor, published in 1909. The natural result is that significant recent developments in the administration of

this system receive no attention. A more serious limitation due to reliance upon secondary sources is the incomplete analysis which appears at times to be the result. For example, if field investigation might have supplemented the extensive office research on unemployment insurance initiated by American employers, the existence of problems at present unrecognized might have come to the fore. As a result, the analysis might have been more penetrating, and other conclusions might have been reached.

The incomplete analysis at this point is the more unfortunate because it gives the impression of biased work. For example, although trade union out-of-work benefit funds are criticized because they are loosely administered and because "the relation between benefits and contributions is unstable and uncertain," the same criteria are not applied to employers' schemes. This omission is the more serious because it is frequently charged that in the comparable field of employers' sick benefit funds the financial arrangements are unsatisfactory. While the "inferior" provisions of trade unions are dismissed from further consideration—in part because of other objections—the future of American unemployment funds is made to rest upon employers' unemployment benefit funds. At this point there is no consideration of the relative protection offered by employers' plans and by current American legislative proposals. Such a comparison would have shown that as the result of a difference in the scope of unemployment as commonly insured by employers and as outlined in proposed legislation, employers' plans usually afford protection only to permanent employees of the individual plant when temporarily laid-off. Legislative proposals, on the other hand, aim to insure the labor reserve of industry. Because of this distinction, even a 100 per cent development of employers' unemployment insurance is not a substitute for the more comprehensive provision possible under the current legislative proposals. But this difference the report does not recognize in its discussion of the relative merits of the two methods of insurance.

In the theoretical aspects of the problem, two ideas are dominant; first, the part played by prevention, and secondly, the charitable aspect of social insurance as provision for those unable to provide for themselves, that is, as a subsidy of earnings. Prevention assumes such an important place that the principle is laid down that before insurance can be applied economically to a hazard, the risk must be stabilized and reduced as far as possible. But prevention which is thus a prerequisite is also made the criterion of the success of various forms of unemployment insurance. But if prevention of unemployment be the measure of success from an insurance point of view, it appears illogical to require as a preliminary to its application that the hazard of unemployment be reduced to a minimum. And yet, it is precisely on this count, among others, that the possibility of unemployment insurance through legislation is considered inadvisable in the United States. In this connection the report points out that in this country the labor reserve is larger than in European nations, and argues that until American unemployment is stabilized and reduced, insurance on a large scale cannot be recommended. In other words, the seemingly courageous admissions concerning the extent of unemployment in

this country and concerning the untried possibilities for its reduction redound at this point to the advantage of the employing group—they form an argument for staving off unemployment insurance legislation.

In the discussion of the ability of the American wage-earner to make individual provision for unemployment, the question of financial ability is made to turn upon the proportion of industrial workers who actually receive during employment an income which is at least 12 per cent above the cost of living—for the Board has estimated that unemployment means an average loss of 12 per cent of the workers' possible yearly earnings. At this point a previous conception of insurance is forgotten, and no indication is given that unemployment is a hazard which affects workers unequally and that it is the unequal incidence among individuals which makes it a risk against which it is desirable to insure. Obviously, regardless of the possibility of determining what proportion of workers have earnings 12 per cent above the cost of living, the receipt of an income sufficient to meet the *average* loss does not assure that *individuals* within the group will be protected.

In conclusion a word should be said about the psychological setting in which this presentation of fact and theory is given. Although the report has the appearance of carefully considering alternatives, it succeeds in leaving the impression that the difficulties facing unemployment insurance through legislation are insuperable.

OLGA S. HALSEY

Wages and Hours in American Manufacturing Industries, July, 1914–January, 1922, by the National Industrial Conference Board, Research Report Number 52. New York: The Century Company. July, 1922. 236 pp.

Since March, 1919, the National Industrial Conference Board has published five reports presenting the results of extensive inquiries on wages and hours of labor in industrial establishments throughout the United States. The latest report presents statistics of wages and employment for July, 1914, and for each month from June, 1920, to December, 1921, for concerns in twenty-six industries, employing in June, 1920, more than one million wage-earners. The report was available for distribution on September 8, 1922.

After a general summary of 34 pages, which includes an interesting computation of real wages as distinguished from money wages, the report is in standardized form. Figures are presented for each industry in four standard diagrams and three tables together with a running text, which to a considerable extent repeats the information shown in the tables and diagrams. The typography of the report is excellent, and the diagrams are well drawn.

While the data presented by this report are in certain elements identical with those collected currently by the New York State and the United States Departments of Labor for employment and earnings in factories, the tabulations are unique in several respects. In the first place, hourly earnings as well as weekly earnings are presented, along with data for the standard and actual

working weeks. The figures make possible a closer analysis of the effect of part-time employment on earnings than is elsewhere available.

In the second place, wage and employment figures are classified under three headings—skilled men, unskilled men, and women. The report gives some statistical verification to the statement often made that in the past two years women have frequently been employed to do work formerly done by men. From a low point in January, 1921, the number of women employed by reporting concerns showed a distinct increase, while there was a continued decrease in the number of men workers until a low point was reached in July. There accompanied this difference in employment conditions a difference in wage conditions: women's wages remained about the same while those of men continued to decline until nearly the end of 1921.

This latest report, like its predecessors, takes its place as an important source-book on wages and employment. There are, however, distinct limitations to its usefulness. For the careful student, a serious limitation is the failure of the authors to include in the report a complete statement of the methods pursued in securing the data, the number and nature of the questionnaires sent out, the selection of the mailing list, etc. The usefulness of the report would also have been increased if the returns had been classified by size of plant, and by geographical divisions as well as by industries. It would, further, have been of much value if the distribution of wages as well as averages had been given.

The value of the report for those guiding the policies of industrial concerns is considerably diminished by the fact that it did not appear until nine months after the last month for which data are included. And the reader with more general interest finds himself wishing that less of the text of the report had been devoted to a listing of figures and more to an interpretation of the meaning of the data.

In pointing out these limitations to the value of the report, it is recognized that their removal would involve a considerable amount of additional labor, and that the report now represents a large expenditure of effort. The very fact, however, that a tremendous amount of labor has gone into the inquiry both on the part of the Conference Board and on the part of those who furnished information, carries with it responsibility for squeezing from the returns all the significance they may yield.

The five wage reports of the Industrial Conference Board furnish an important body of information concerning wage and employment changes during and after the war. As successive reports have been issued the scope of the inquiry has been broadened, and the results have been presented in more comprehensive form. It is to be hoped that the future studies, which we trust are in prospect, will be still further extended to include those cross tabulations of the data which have been suggested above, and additional explanatory and interpretative material.

W. Randolph Burgess

A Study of Price Control by the United States Food Administration, by Rev. Joseph C. Bartley, O. S. A., Villanova, Pa., 1922. 138 pp. (A Dissertation submitted to the Faculty of Philosophy of the Catholic University of America in partial fulfilment of its requirements for the degree of doctor of philosophy.)

The discovery that a doctoral thesis on price control by the United States Food Administration had been published in 1922 led the reviewer to conceive unduly extravagant expectations. The study made by Paul W. Garrett and others on "Government Control Over Prices," which was published in 1920, characterized the regulation of food prices as the most nebulous war control exercised in America, and the most far-reaching and direct in its touch with the civilian and soldier.[1] While this study by the War Industries Board was being made, however, the descriptive task relating to the economic experiment in war-time food control for the principal commodities was being undertaken and subsequently was capably executed through the joint, though uncoördinated efforts, of writers who had been actively connected with the work of the Food Administration, the investigators of governmental agencies such as the Federal Trade and Tariff Commissions, and the university economists and statisticians writing in the journals of their respective crafts.[2] One need not mention the numerous Congressional hearings which make available much valuable though rambling material. Consequently, by 1922 the nebula referred to above had precipitated itself into a somewhat pretentious planetary system.

It was to be anticipated, therefore, that a study published in 1922 would correlate all this special data into a comprehensive, well-integrated, compact study, in which the hitherto unrevealed underlying factors determining the policies and activities of the Food Administration would be given due attention, instead of the somewhat empirical phenomena placed on record by the previous writers at a time when nothing more could be observed. The results of control could be traced with the abundant post-war statistical material available, and the relation of the control period to the cycle of inflation which followed could be pointed out. It was even to be hoped that the bearing of the experiment upon moot questions of economic theory would be noted. What light, for example, had been thrown upon the concept of elasticity of demand, the interreaction of supply and demand, etc.?[3]

It was a disappointment, therefore, to find in the preface the author's frank statement that "the aim of this study is to present a historical account of the work of the Food Administration from an economic viewpoint." Furthermore, the dissertation is confined to a few basic commodities with which the general work of the Food Administration was concerned. The apology for failing to

[1] War Industries Board Price Bulletin No. 3, p. 40.

[2] Such as, for example, Wilfred Eldred's article on "The Grain Corporation and the Guaranteed Wheat Price," *Quarterly Journal of Economics*, XXXIV, p. 698, the reports of the Federal Trade Commission on Milk and Milk Products, 1914–1918 (June 6, 1921), and Canned Foods (May 15, 1918); the Tariff Commission's study on Refined Sugar, Cost Prices and Profits. (Tariff Information Series, No. 16, published in 1920); Professor Taussig's and Kemper Simpson's articles in the *Quarterly Journal* in 1919 on price-fixing.

[3] See, for example, Professor Taussig's article, "Is Market Price Determinate?" *Quarterly Journal of Economics*, XXXV, p. 394.

present a complete account is that over 300 separate commodities were under control during the war, with regard to which scarcely any written record exists. This limitation in the study is to be deemed lamentable since the minor commodities, though unimportant with respect to the magnitude of the industries affected, revealed interesting sidelights on important economic problems.

Although an extremely significant field of inquiry has thus been left unexploited, a distinct service has been rendered by Father Bartley in the presentation, within one hundred and twenty-two pages, of the causes which led to the control of the important commodities, the analysis of the Lever Act, the general nature of the Food Administration policies (which were predetermined, as the author correctly points out, in large measure by the nature of the Lever Act itself), and the history of control for each of the important commodities.

In Chapter I, "Price Control and Price Fixing," an attempt is made to clarify the terms "control," "rationing," etc. Any one who has reflected seriously on war-time experiments in various forms of participation in industry and trade by the national government, or its regulation or control thereof, will appreciate the service to be rendered by the thorough overhauling of the illogical and vague terminology hitherto employed. What justification can there be for applying the term "control," for example, to the actual purchase and sale by an agency of the national government of the entire Cuban sugar crop? This was participation in business, not control. In Chapter I, however, Father Bartley labors under the handicap of placing on record that which has been thoroughly impressed upon the mind of the economist through daily casual observation of the phenomena and reflection thereon during the period of war-time control, and many statements, therefore, appear truisms at first reading. The economist is now prepared after the orientation of recent years for a more rigorous analysis of the subject than is here given.

In the second chapter, "Beginnings of Government Control," the statistical data are presented on the rise in prices during the latter months of 1916 and the early part of 1917 and on the other factors which led to the enactment of the Lever Act, such as the threatened wheat and sugar shortages and the imminence of inflation consequent upon large army and navy purchases. A few pages are then devoted to the passage of the Lever Bill and its general provisions, after which attention is given to the policy of the Food Administration in the execution of the licensing feature provided for in Section 5 of the Act, which is designated by the author as the "soul of price control." The difficulties inherent in any application of such vague terms in the law as "reasonable margin of profit" and "cost basis" are outlined.

The following four chapters deal respectively with wheat flour and bread, sugar, meat and dairy products, and canned goods. Father Bartley has given a competent running survey of the outstanding facts of the control of each of these commodities, but it is disappointing to find that he has presented few satisfactory conclusions. In some cases he is content with reproducing the Food Administration's own evaluation of its work. Thus, for example, with regard to that memorable conservation measure, the "meatless" day, he reproduces the Food Administration's estimate of a conservation of over 100,000,000 pounds of

beef in four months, and with respect to poultry, he presents its statement that at least 3,000,000 hens in New York, Chicago, and Boston alone were saved. Again, in dealing with canned goods, he gives the Food Administration's estimates of a saving to consumers of $7,000,000 on the 1918 pack of peas, tomatoes, and corn achieved through its control of canners' margins.

With respect to the effect of the Food Administration's policy in control of sugar on the production of this commodity, Father Bartley merely paraphrases a conclusion presented by the reviewer in an article in the *Quarterly Journal of Economics* as far back as August, 1919. There is no evidence that he has taken into consideration the more ample statistical data which have become available since that date.

In regard to the control of wheat flour and bread, the author says:

> Government control seems to have curbed the price of bread to some extent. Compared with the price level of the six months preceding government control there was but a three per cent rise in the price of bread during the war. After the regulation of the Food Administration was removed, about January 1, 1919, the price of bread advanced to 8.5 cents, or an increase of eleven per cent over its pre-war average. (Page 55.)

There is no examination, however, of the other factors involved in the situation, so that the reader is unable to determine whether the evidence is to be taken as conclusive on the effectiveness of government control in this respect. Conclusions such as "regulations for the packing industry were not as successful as the Food Administration expected" (p. 81), or "the formula method,[1] while accurate as a method for ascertaining production costs, is not infallible" (p. 98), are obviously barren. It must be remembered, however, that the author has undertaken a descriptive function primarily, not a critical one, so that it is perhaps unfair to expect evaluations or conclusions more definitive than those given.

Chapter VII deals with the control of the unlicensed retailers and is confined merely to a description of the operations of the system of local "fair-price" boards. A concluding chapter traces the manner in which the organization of the Food Administration and its policies reflected the limitations and defects of the Food Control Act. Attention is directed to the fact that "the principle of the Food Administration was the firm belief of its leaders in the efficacy of voluntary coöperation." The general conclusion reached by the author is that the Food Administration exaggerated the evil due to lack of legal definitions in the Act as to what constituted just and reasonable profits, and made this an excuse for inaction. On the other hand (page 122) he says, regarding the Food Administration:

> It showed itself fairly well adapted, however, to meet the ever-changing conditions of the time. It possessed the advantage of being able to recruit many of the country's best business and scientific men, and place them in positions of leadership. The organization was a practical and efficient institution, and despite the defects mentioned, was a credit to our war-time achievements.

[1] Referring to the adoption, as the basis for prices to be paid dairymen for milk, of the modified Pearson formula and the Warren formula by the Chicago and New York Milk Investigation Commissions respectively.

An appendix has been inserted containing some notes on early attempts at price-fixing, beginning with an example in the State of Athens in the third century B. C., and concluding with a few experiments in the United States of the period, 1776–79. On the basis of his study the author reaches the somewhat threadbare conclusion that "price fixing is an artificial arrangement which seriously disturbs the operation of economic laws and interferes with business activity." More constructive and rather interesting is his observation at this point (page 135) that "any system of price-fixing to be successful must be based on close adherence to economic principles and market conditions" and "the more directly prices are fixed, the less chance they have of being observed."

On the mechanical side the statistical tables are often rather crude in arrangement, and their headings are frequently almost indistinguishable from the text. In the footnotes the use of "*ibid.*" would often have made unnecessary the repetition of full citations. The editorial lapses range from an innocuous and amusing one such as "This corporation headed by some of the country's best wheat *exports*," to confusing, though not seriously annoying, statistical errors such as on page 60 where the exports to the Allies in 1916 are given both as 1,242,740 tons and 473,506 tons, within a few lines.

The dissertation visibly embodies results of a wide range of reading. It is therefore difficult to see why one so well acquainted with the authoritative documents should refer so frequently to the Food Administration News Releases, which were to a considerable degree simply a part of the propaganda of a War Administration. They were not always prepared carefully because of the great pressure at the time, and were hardly meant to be guides for scientific inquiry even by those who prepared them. One may well question also the usefulness of quotations or references in a doctoral dissertation from the trade journals, such as the *Reliable Poultry Review*, or periodicals such as the *Literary Digest*.

On the whole, as already stated above, this study will be useful for those seeking a quick running survey of war-time food control of the principal commodities. It is the reviewer's sincere prayer that no more time and energy will be devoted by students in any additional work of description or of general and empirical evaluations of the food control experiment. The Food Administration was, after all, merely a war agency, and every one now knows that it succeeded reasonably well in preventing runaway markets such as would undoubtedly have developed without some form of control, and that it lessened the hardships and inevitable friction between various groups in the community during a period when normal operation of economic forces was seriously interfered with. The requirement now is for an inquiry such as is described above with respect to single commodities. When these are completed the results may be combined and some fundamental questions answered.

JOSHUA BERNHARDT

Washington, D. C.

Distribution of Income by States in 1919, by Oswald W. Knauth. New York: Harcourt, Brace & Co. 1922. v, 30 pp.

This is another product (or by-product) of the work of the National Bureau of Economic Research. "It is issued at this time in order to meet the special needs of many investigators concerned with the comparative capacity of the various states to bear increased taxes, to buy goods of various sorts, to absorb securities, etc. It also indicates the relative importance of agriculture in the different sections of the country" (page v). The problem is mainly one of apportionment to reach "a rough set of approximations" (page v). The basis is largely the Census of 1919, which fact determines the date of the estimate.

Income of persons receiving over $2,000 a year, as shown by states in the Statistics of Income published by the Internal Revenue Bureau, is subjected to deduction to eliminate farmers' income, then adjusted for under-reporting and tax-exemption. Incomes under $2,000 (again other than those of farmers) are apportioned largely from numbers in gainful occupations as a starting point, with the aid of wage data from various sources. Farm laborers are similarly, but separately, dealt with. In estimating farmers' incomes the 1919 Census of Agriculture and compilations of the Department of Agriculture are used. Corporate surplus of two billion dollars is apportioned according to the net value added by manufactures as computed in the 1919 Census of Manufactures. A note from Professor A. A. Young, one of the Directors-at-Large of the Bureau, calls attention to his unwillingness to accept responsibility for the general validity of the assumption that income-tax evasion is distributed among the states in the ratio of income taxes paid; but he sees no practicable and expedient alternative to such an assumption for the purpose in view (footnote, page 2).

The combined results contain nothing conspicuously improbable. The matter-of-fact descriptions of methods employed indicate painstaking and impartial work involving many assumptions, which, however, are evidently necessary, and for the purpose, reasonable.

G. P. WATKINS

Washington, D. C.

Digest of Business Statistics: A Comprehensive, Concise and Practical Compilation Specially Prepared for the Use of Sales and Advertising Executives, by Joseph E. Austrian. New York: Joseph E. Austrian. 1922.

This is a compilation of information bearing on market and sales conditions in the various states. It is based for the most part on data gathered in the census of 1920, though a few of the tables are from other sources. These tables are apparently exact reproductions, and therefore contain all the qualifications to which the original are subject. In the main, therefore, the book may be described as a selected compilation of census material, presented in a small compass for the handy reference of those who are in constant need of these data.

O. W. KNAUTH

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